ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

Vol. LXVII, No. 20. CHICAGO, SATURDAY, NOVEMBER 13, 1915. ISSUED WEEKLY

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer. A. A. Gray, General Manager.

C. W. Forbrich . . . . . Manager Western States. Chicago, Ill.

E. E. Wood . . . . . 13 Park Row, Manager Eastern States. New York, N. Y.

J. B. McCarthy . . . . . Manager Middle States. Detroit, Mich.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich .....Associate Editor

MEMBER THE SOCIETY FOR ELECTRICAL DEVELOPMENT INC. DO IT ELECTRICALLY

SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back one month, each.. .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
- Accurate Estimating for Proposals....879
- Public Policy Advertising....880
- The Sale of Energy to Municipalities....881
- Intensive Cultivation of Central-Station Business....881

DEPARTMENTS:
- Commercial Practice....889
- Electrical Construction....894
- Public Service Commissions....897
- Questions and Answers....899
- New Electrical and Mechanical Appliances....906
- Latest Approved Fittings....912
- Current Electrical News....913
- Record of Electrical Patents....917

LEADING ARTICLES:
- Electricity in Harvesting Works....883
- The Sale of Current to Municipally Owned Distributing Systems by Central Stations.—By W. Rawson Collier....890
- The Temperature of Field Windings.—By H. M. Phillips....894

MISCELLANEOUS:
- Formation of N. E. L. A. Technical Section....882
- Constructive Activities of Kansas City Electric Club....882
- Election Results Affect Utilities at Toledo, Cincinnati and Detroit....882
- Lighting of Office Buildings....882
- Electricity Used for Lighting Monster Birthday Cake....889
- Suggestions for Central-Station Advertising Managers....889
- Texas Company Encourages Dealers to Form Christmas Club to Stimulate Appliance Business....893
- Electrical Installation in Seattle Warehouse....895
- Installation Rules for Gas-Filled Incandescent Lamps....896
- Repairing a Motor....896
- Among the Contractors....896
- Submarine Batteries Discussed at Court Martial....898
- Generating and Distribution Statistics of Pacific Power & Light Company....901
- Extraordinary Telephone Development in Chicago....901
- Railway Electrification at Sydney, Australia....902
- Institution of Electrical Engineers....902
- Causes of Electrical Accidents in English Collieries....903
- Novel Features to Characterize Electrical Prosperity Week in Many Cities....904
- Milwaukee to Have Electric Show During Prosperity Week....904
- Steel Electrically Produced Direct from Ore....904
- Massachusetts Municipal Electric Plants....905
- Resistance of Radiotelegraphic Antennas....905

Copyright, 1915, by Electrical Review Publishing Company, Inc.

ACCURATE ESTIMATING FOR PROPOSALS.

Inspection of the bids submitted by electrical contractors in a great many cases discloses a surprising variety in the amounts bid for exactly the same work. It is not easy to believe that such wide variations exist in the actual carrying out of the work by different firms if it is done according to the specifications. It may be that the diversity in the amounts bid is greater in cases where specifications are not definite, but even in cases where the specifications leave no doubt as to the work to be done very wide ranges in the amounts of bids are frequently to be noted.

In some cases the contract for electrical construction work is not given to the lowest bidder, but to one who can be expected to do the best at a reasonable price. In a majority of cases, however, the work does go to the lowest bidder if he is regarded as a responsible party who can be depended upon to carry the execution of the work to a finish. The result is that contracts frequently go to electrical contractors who carry out the work at a loss, and frequent failures of men engaged in this business are the well known result. It is of interest to inquire why such big differences should exist between different bidders for doing identical construction work.

In any case where there is a variety of bids it is probable that while some are below the actual cost of doing the work others are much higher than actual cost and represent an extortionate profit. In either case the condition may not be a deliberate one upon the part of the bidder, but may represent his ignorance as to what will be the cost to him of carrying out the specified work. In other words, his bid is nothing more than a fairly good guess. In other cases estimates have been made of the cost but the estimating has been done so poorly that the result is not even a close approximation of what the cost will turn out to be. Poor estimating is therefore a frequent occurrence.

The necessity for accurate estimating of jobs of electrical construction cannot be too strongly emphasized. Two things are necessary for an accurate estimate. One is that all of the work to be done should be included and none of it overlooked. The other is a knowledge of the unit costs for different kinds of work. To insure that a complete list of the material required should be drawn up, it is of great value to have blank forms on which all possible requirements are listed, and the filling out of one of these blanks will safeguard against overlooking any important items.

Such blanks can be drawn up in different forms for different classes of work. To estimate labor costs accurately it is necessary to have an accumulation of data from previous installations. This points to the importance of keeping records of time and costs on all work done and of summarizing these in such form that they are available for reference and for application to future jobs. The successful man in this, as in most other lines of business, is the man who knows his unit costs.

Next to accurate estimating of the cost of material and labor comes the inclusion of a proper allowance for overhead expenses. A few years ago this was a much neglected item of cost but so much emphasis has been laid upon it by the associations of contractors and others that it would seem doubtful that any contractor could fail to make some allowance for it. However, in many cases ignorance of the actual value of the overhead expense prevents the making of an accurate allowance and here again accuracy depends upon the existence of proper records in the bookkeeping department. It should be recognized that overhead expenses vary from time to time with conditions of work, with the volume of business transacted, etc., and that percentages that apply at one time to one firm do not necessarily fit another time or another firm. Accurate cost keeping is necessary for the contractor to know just where he stands in this respect.

It must be admitted, however, that all low bids are not due to ignorance as to costs, but that they sometimes result from a deliberate purpose to cut under the bid of other contractors for the sake of securing the contract, even though this may be done at a loss. This is not only as a rule poor business, but it often represents a low standard of ethics as well. The loss on a certain job may in some cases be regarded as an advertising expense, but it is very questionable as to whether this is the most desirable form of advertising. A reputation for cheap work is not nearly so valuable as a reputation for first-class work. In other cases it may be expected that by skimping in material or in work it will be possible to get by at the figure quoted by not strictly adhering to the specifications. This of course is a form of dishonesty and should not be considered by any reputable contractor. Another motive which applies in certain cases is that although no money may be made upon the main contract, there will be extra work not covered by the specifications for which a high enough price may be charged to let the contractor come out not only without a loss but perhaps with a substantial profit upon the entire job. This is not only poor business but it is also very risky. It frequently occurs that high estimates on the extras result in this part of the work going to a different contractor and the original bidder is thus left in the lurch. Each job of work and each part of a job should be taken only on the basis of a price which will pay for its own cost and leave a little margin for the contractor. The hope of getting additional work on the basis of a job done at a loss often proves a will-o'-the-wisp.

PUBLIC-POLICY ADVERTISING.

There hardly seems a need to emphasize the importance and value of public-policy advertising to central-station companies as it is quite generally recognized that the good will of the public is the most valuable asset of a utility. However, experience has demonstrated that without educational stimulus the public is prone to accept the activities of the central station towards rendering good service as a matter of course and without any special appreciation.

Public-policy advertising does not necessarily mean the use of big space in the newspapers or a continual harping on the excellence of the company or its methods. In fact, this style of advertising frequently leads to the belief that the company is seeking to defend itself from some attack or agitation which it has reason to fear. The education of the public is really the goal to be reached. Central-station companies are in business to make money. There should be no juggling of words to give the impression that the sole reason for the existence of the utility is to build up the community or serve the people. It necessarily follows that the central station can only be successful and earn a profit by serving the public adequately and this is the fact that should be emphasized, not only in newspaper advertising but by actually giving good service. Frankness and honesty are the two prime requisites in a public-policy campaign. The average citizen cannot be educated to an intelligent understanding of the technicalities of the electricity supply business. Moreover, he is not interested. But he must be brought to a realization that the utility is doing a legitimate business in a legitimate manner.

Central stations in small towns have felt that they could not afford public-policy advertising, and yet municipal ownership and municipal competition make the greatest strides among the smaller communities. The utility is not always at fault, but in many instances such action could be averted if the public were educated to a proper appreciation of the company serving the community. It is not necessary to segregate public-policy advertising in newspapers and thus double the expenditure in this direction. Every advertisement, whether devoted to house-wiring, power or appliances can be made to carry a message to the public which will do its share in molding favorable sentiment.

Unfortunately many companies do not give public-policy advertising a thought until confronted with an organized movement for confiscatory rates or municipal ownership. With the company placed in the position of defending its very existence, it is extremely difficult to convince the public and in several notable instances lavish expenditures in this direction have proved of no avail. Public-policy advertising should be considered much in the same manner as fire or liability insurance and action should be taken before circumstances arise which force an issue.

THE SALE OF ENERGY TO MUNICIPALITIES.

The subject of the sale of energy to municipally owned distributing systems by central stations, while a comparatively new one, is nevertheless assuming important proportions and must be given serious consideration. It is well known that the tendency in central-station development is towards centralized generating plants with transmission lines radiating in all directions, forming a network of correlated lines. In Connecticut, Illinois, Montana, and sections of the South, there have already been effected important mergers and rehabilitations looking to this end. As these transmission companies gradually extend their lines they are confronted with the difficulty of being unable to sell their product in towns where municipal lighting plants and municipally owned water-works systems are in operation, on account of the fact that the cities owning these plants are usually unwilling to grant the power companies a general franchise to enter the town for fear that they would prove a serious competitor. The only alternative is to sell energy to these municipally owned distributing systems, and where such activity has been undertaken the success has been extremely gratifying. In Georgia, for instance, of 35 municipally owned plants within easy access to transmission lines 26 are operated with energy purchased from hydroelectric companies. It is reported that in every instance the purchase of electricity has proven a good investment to the town, and in almost every case the citizens are more than well pleased with the service that they are obtaining.

On other pages of this issue there appears an article on this subject by Mr. W. R. Collier, which contains a considerable amount of important data which are well worth the attention of central stations confronted with the necessity of interesting municipalities in the purchase of power. Fortified with this information, Mr. Collier found it comparatively easy to convince city councils that by the non-use of their steam plant throughout the greater portion of the day they will actually be losing a great deal of money and that this loss would be considerably lessened if energy were purchased from a central-station, as the latter sells its energy as a finished product at the switchboard. The situation is exactly parallel to that of interesting managements of industrial plants in purchasing power, and should be undertaken with the same conviction of success that has been largely responsible for the enormous power loads now enjoyed by central stations throughout the country.

From the point of view of revenue and average rate this type of business is extremely profitable. The commercial cost in serving municipalities is extremely small, as an entire community is represented by one meter, one bank of transformers and one account. As a general rule the bills are paid promptly, there are few complaints and the cost of holding the business after it is once signed is nil. It also follows that where energy is furnished to municipalities the supply company is often able to obtain a satisfactory unlimited-term franchise which, while prohibiting competition with the municipal plant, often permits of securing large power business, say in amounts of 50 horsepower and over.

INTENSIVE CULTIVATION OF CENTRAL-STATION BUSINESS.

The Boston Edison Company is completing an exhaustive canvass in its territory which was undertaken to determine first, the exact conditions in every building in the territory supplied by the Boston Edison Company, and secondly, to increase the uses of electricity of every existing customer, and, finally, to secure the greatest number of prospects for additional uses of the service, as well as prospective new customers. Sufficient progress has been made to furnish conclusive evidence that the expense of this undertaking is justified by the data that have been obtained. The new-business department now has available a vast amount of pertinent information that will permit of more intensive cultivation of business among existing customers which, as is well known, is in many cases more profitable than entirely new business which makes necessary line extensions and transformer and meter installations.

A canvass such as that mentioned involves rather heavy expenditures and principally for this reason may seem to apply only to the larger companies. However, if the actual collection of such data were combined with an inspection of a customer's installation, a notation of damaged or worn out equipment, or perhaps the repairing of such damaged equipment at the time of the representative's visit, a service would be rendered that would mean much toward holding the good will of the customer and insuring the greatest possible utilization of his installation.

In the desire to acquire business central stations too often have ignored existing customers, and thus have not only passed by opportunities for increasing the revenue with a minimum expenditure of capital, but, what is of greater importance, have developed the impression that when once a contract is signed the company forthwith loses interest in the customer.

Many progressive managers have so fully appreciated the necessity of periodic visits for inspection of customers' installations that a separate department has been established to carry on this work. If such visits would combine a tabulation of the opportunities for extending the installation, adding equipment, or in other ways increasing the customer's use of energy, such as accomplished in the Boston canvass, the sales departments would be provided with excellent lists upon which to concentrate their energies and the good will of the customers would be greatly enhanced.

Formation of N. E. L. A. Technical Section.

A meeting of the Executive Committee of the proposed new Technical and Hydroelectric Section of the National Electric Light Association was held at the Engineers' Club, New York City, on November 3. The Committee had been requested by President E. W. Lloyd, in accordance with the recent authorization by the national Executive Committee, to organize the section.

The following officers were elected: chairman, Holton H. Scott; vice-chairmen, P. M. Downing, J. T. Hutchings, R. J. McClelland, Charles Ruffner; secretary, S. A. Sewall.

These officers will constitute the governing body of the Section until the regular election of officers by the Section itself at the next annual convention.

All of the technical members of the association automatically become members of the new section and new members will be added to the section on their personal choice. The technical membership of the Association is by far the largest group and the new section will consist of several thousand members. It will take under its jurisdiction nearly all of the technical committees, such as Overhead Line, Prime Movers, Electrical Apparatus, Meters, Underground Construction, Grounding Secondaries, Electrical Measurements.

It was proposed by Mr. Torchio that a new committee be constituted to study and report on the newer industrial applications of electricity from the technical side, so as to be of use in furnishing data and information to member companies and the Commercial Section. This proposition was very favorably considered.

Steps were taken to formulate a constitution for the section and a variety of interesting business was discussed.

Constructive Activities of Kansas City Electric Club.

The Jovian Electric Club, of Kansas City, at its annual meeting and banquet on the evening of November 2, elected the following officers: President, H. F. Lang, Missouri & Kansas Telephone Company; vice-president, J. D. Todd, Western Electric Company; second vice-president, A. P. Denton, Denton Engineering & Construction Company; third vice-president, A. N. Richardson, general superintendent Kansas City Electric Light Comany; fourth vice-president, W. S. Blue, Westinghouse Electric & Manufacturing Company; secretary and treasurer, C. W. McDaniel, Missouri & Kansas Telephone Company. Board of Control (four members elected), F. M. Bernardin, P. Lloyd Lewis, R. D. Obermeyer and F. B. Uhrig. Following the entertainment features of the meeting, several members were called upon to outline the possibilities of work for the club. Edward E. Ingels suggested a study of all public movements, particularly legislative, that would affect the electrical industry, and the closest sympathy and co-operation between all the various phases of the industry. He made the suggestion that a ways and means committee be appointed to outline a plan of work for the club. E. G. Jacques, as representative of manufacturing interests, urged that the entire industry, in all its phases, get busy at once in planning work that will take the place of the war outlets when the war is over. He urged individual enthusiasm concerning the club activities.

E. S. Cowie spoke as representing the contractors, saying that the contractors were at point of contact with more different interests than any other branch, and they provided the contact with the purchasing public. Mr. Cowie said that because of this situation the contractor got enough business and also he was an important factor in the trade, and should have a larger share in the work of the Jovian Electric Club. He urged the officers to give the contractors work in the club, and to insist on the attendance and membership of that branch.

A. N. Richardson spoke as a representative of the central station, mentioning the increase in customers from under 10,000 five years ago to more than 40,000 in November, 1915. He said that he knew the club and the electric company were eager to do all possible in the further development of electrical usage. A resolution was adopted providing that a committee be appointed to carefully outline a program of work for the club.

Election Results Affect Utilties at Toledo, Cincinnati and Detroit.

Despite the frank, outspoken, advertising campaign which was personally conducted by Henry L. Doherty in the interest of a new railway franchise for the Toledo (Ohio) Railways & Light Company, the voters of that city on November 2, defeated the project by referendum vote.

At Cincinnati, the 8.5-cent electric-rate ordinance was carried by a substantial plurality. By the terms of this law the rates of the Union Gas & Electric Company are to be established by the Ohio Commission and the attack of an organized body of citizens on the ordinance, based on a demand for a six-cent rate, is ended.

At Detroit, the voters defeated the proposition to purchase the car lines.

Lighting of Office Buildings.

On the evening of Thursday, November 4, the Chicago Section of the Illuminating Engineering Society held its first meeting of the current season in the Edison Building. Chairman E. W. Lloyd presided and there were about 200 persons present. The paper of the evening was by W. A. Durgin and J. B. Jackson, entitled "Semi-Direct Office Lighting in the Edison Building of Chicago." Mr. Durgin presented the paper, which was illustrated by lantern slides, and described the units used in lighting the offices of the Commonwealth Edison Company, as well as the work of investigation and test which led to the adoption of the units chosen. This is the same paper which was presented at the annual convention of the society in September.

The paper was discussed by Albert Scheible, James R. Cravath, C. A. Luther and J. B. Jackson. The discussion brought out that the Committee on Glare has set a limit to the relative brightness between lighting unit and background at 100 to 1 to avoid glare. The values in these offices are in the ratio of three to one. Cleaning of the bowls is necessary only on the inside. Lack of cleaning results in a decrease from the original illumination to 75 per cent of its value in three weeks.

New England Vehicle Association Elects Officers.

At the recent annual meeting of the New England Section, Electric Vehicle Association of America the following officers were elected for the ensuing year:

Chairman, J. T. Day.
Vice-chairman, Albert Weatherby
Treasurer, L. L. Edgar.
Secretary, C. H. Miles.

Executive Committee, E. S. Mansfield, W. A. Blachford, R. B. Daggett, George H. Hudson, F. M. Kimball, F. J. Stone, C. A. White and Frank H. Smith.

National Fuel Conservation in England.

A committee consisting of representative chemists, engineers, and technologists from all the principal industrial areas in England has been appointed to consider and report upon the question of fuel economy, especially its national bearing. Both the utilization of coal and smoke prevention will come within the compass of the inquiry which is being made as the outcome of a discussion which took place at this year's meeting of the British Association. William Bone, of the Imperial College of Science and Technology, London, is chairman of the committee.

Industrial Power Series—Article No. 144.

ELECTRICITY IN HARVESTING MACHINE WORKS.

This article deals with the electrical installation in the plant of the International Harvester Works devoted to the manufacture of tillage implements. It is in a way supplementary to the article describing a similar plant of this company which appeared in the issue of October 23, 1915. The installation comprises 1079 horsepower in motors and all energy is purchased from the Empire Gas & Electric Company.

This article relates to the No. 2 works of the International Harvester Company at Auburn, N. Y. The No.'s 1 and 3 works have already been described in previous issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. The No. 2 works are devoted to the manufacture of tillage implements including harrows and cultivators. The harrows are made in several styles, the disk harrow consisting of a series of slightly conical disks mounted on a shaft with the axes parallel to the earth. The disks are supported and actuated by a single mechanism, all of which are mounted on a two-wheeled truck designed to be drawn by horses. The disk shaft is divided at the center so that the two sets of disks may be thrown at an angle with each other by suitable hand levers. The harrow is drawn over the ploughed field and reduces the chunks of earth left by plowing. There are forgings, castings and numerous machined parts entering into the construction of the harrow. There are also toothed harrows of several styles which are intended to be drawn over the soil to reduce it to a still finer state.

Cultivators have the general appearance of a plow but are provided with a series of teeth and shovel-like blades. These implements are used for loosening the soil around vegetation and some types automatically throw up the earth around the stalks forming hills.

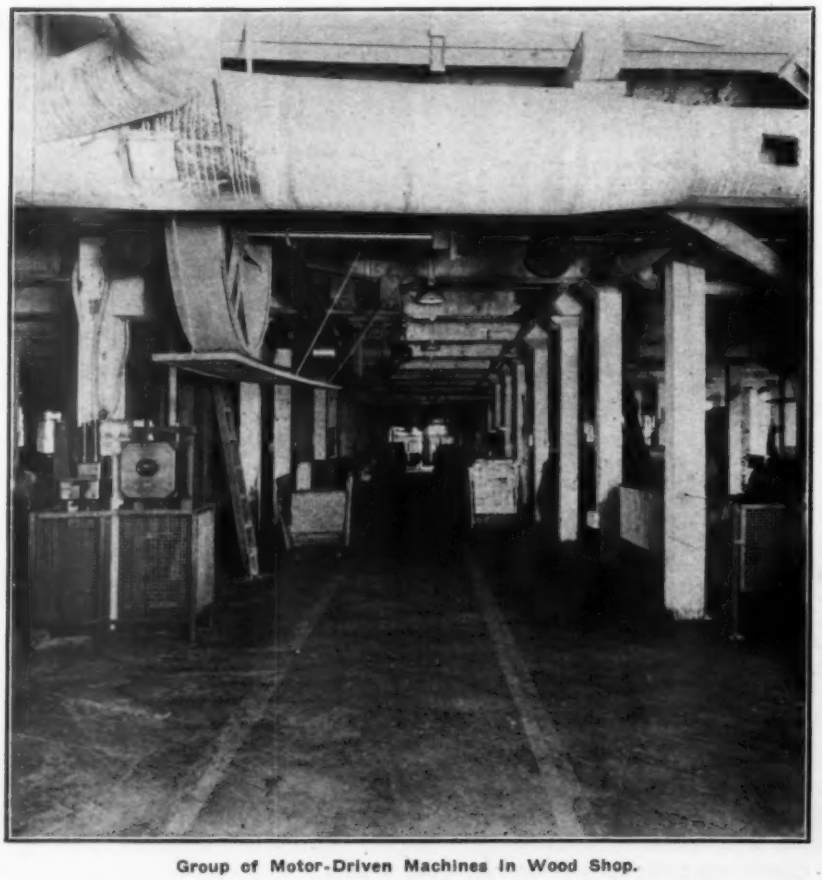
The No. 2 works consist of a malleable-iron foundry, shear and punch shop, harrow shop, paint mills, warehouses, etc. There are 44 induction motors in operation aggregating 1079.5 horsepower, and a number of direct-current motors. The majority of the motors are 25-cycle, three-phase machines operating at 2300 volts, although there are a number of 220-volt direct-current motors for the operation of cranes and elevators. The malleable-iron foundry is the principal

Battery of Casting Tumblers and Exhaust Fan, Motor Driven.

feature of interest and is one of the largest and finest equipped foundries, if not the largest in the United States. The processes carried on here would, of course, be applicable to any industry using malleable-iron castings. In connection with the foundry there is such machinery as tumblers, grinders, drop hammers, dust collectors, fans, etc.

In the article describing the No. 1 plant of the International Company the general advantages of electric power in harvesting-machinery works were discussed. In the malleable foundry where there are many thousands of small castings made daily it is necessary to have some means at hand to quickly handle the work. Electric cranes and electric telphers materially aid and facilitate the various processes. There are three malleable-iron furnaces in this plant, each of 20 tons capacity. Two are located centrally in the foundry with the stack for the escaping gases in the center between the two furnaces. The third furnace is located at the extreme end of the building. The furnaces consist of horizontal brick structures with a furnace at the end farthest from the stack where melting coal is burned. The furnaces are hand fired and use forced draft from motor-driven fans. The balance of the structures outside of the furnaces contain the iron to be melted. Over this section the top is composed of removable sections made up of fire brick and steel. The tops are removed by the cranes while the furnaces are being charged. The molten metal collects at the bottom of the furnace where provisions are made for drawing it off into ladles. Fires are lighted at 3:30 a. m. and a heat taken off at 10:30 a. m. when the furnace is again charged and a second heat taken off at 4:30 p. m. At the present time but two furnaces are used and these on alternate days, one being relined while the other is in use.

Motor-Driven Punches and Shears.

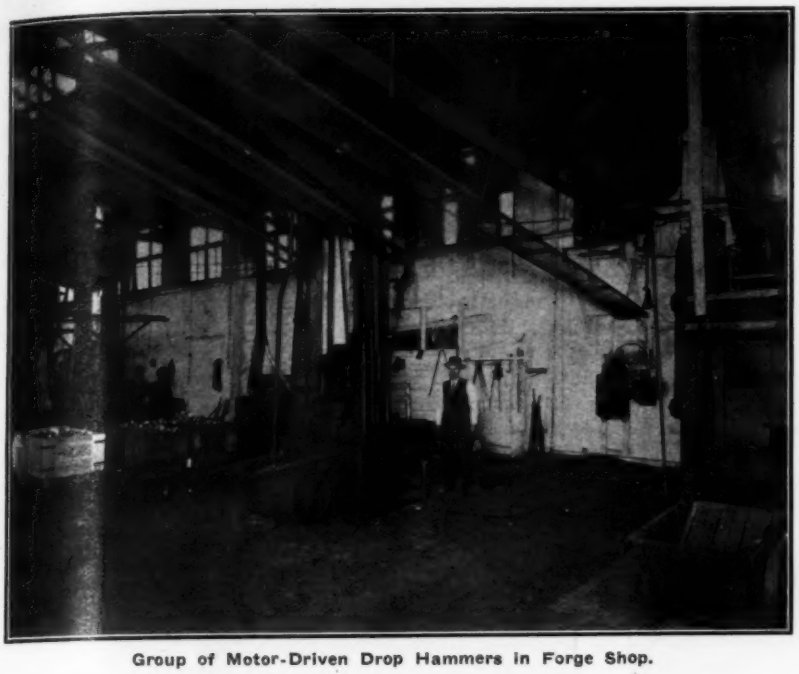


Group of Motor-Driven Machines in Wood Shop.

To make the processes carried on in the malleable foundry clearer to the reader it may be well to outline the manufacture of malleable iron and give some of its characteristics. There are four great classes of work for whose requirements malleable cast iron, commonly called malleable iron, is especially adapted. These are agricultural implements, railway supplies, carriage and harness castings, and pipe fittings. Beside these main classes there are innumerable other unclassified uses.

Malleable castings seldom exceed 175 pounds in weight, three feet in length and three-fourths of an inch in thickness and the large majority of heavy castings do not exceed ten pounds. Malleable cast iron when properly made has a tensile strength of from 42,000 to 48,000 pounds per square inch with an elongation of five per cent in two inches. Much malleable iron for various reasons falls short of these figures and will fall as low as 35,000 pounds per square inch which is sufficient for pipe fittings, hardware specialties, etc. A tensile strength as high as 63,000 pounds per square inch has been reached but this high tensile strength is not desirable as the softness of the casting is sacrificed, and its resistance to continued shock is lessened. For the repeated stresses of severe service the malleable casting ranks ahead of steel, and only where high tensile strength is essential must it be replaced by that metal.

The process of making malleable iron may be summarized as follows: The proper cast irons are melted in the fur-



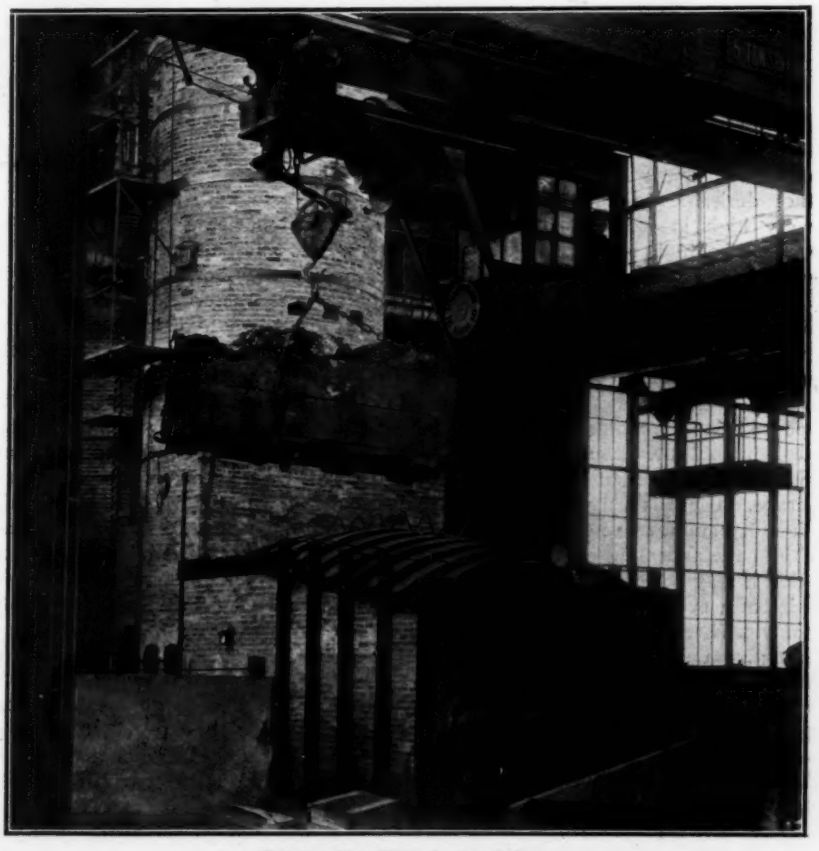
Group of Motor-Driven Drop Hammers in Forge Shop.

naces and when cast into molds must chill white or not more than a little mottled. After removing the sand from the hard castings they are packed in iron scale, or other materials containing iron oxide, and subjected to a red heat of from 1250 to 1350 degrees Fahrenheit for over 14 hours. The castings are then cooled slowly, cleaned from scale, chipped or ground and straightened. When hard or just from the sand, the composition of the iron should be: silicon from 0.35 up to 1.00, depending upon the thickness and the purpose for which the casting is to be used; phosphorus not over 0.225, manganese not over 0.20 and sulphur not over 0.05. The total carbon can be from 2.75 upward, 4.15 being about the highest that can be carried. The lower the carbon the stronger the casting is subsequently. Below 2.75 there is liable to be trouble in the anneal, the blackheart structure may not appear, and the castings remain weak. A casting one-inch thick would necessitate silicon at 0.35, and the use of chills in the mould in addition, to get the iron white. For a casting about one-half inch thick, silicon about 0.60 is the proper limit, except where great strength is desired, when it can be dropped to 0.45. Above 0.60 there is danger of getting heavy-mottled if not gray iron from the sand molds and this material when annealed the long time required for the white castings, would be ruined.

Malleable furnaces have already been described, but it may be said that heat treatment of the metal during the metal process has an important bearing upon the tensile strength, elongation, etc., and excessive temperatures promote the chances of burning. Iron is burnt mainly through the generation in the melting furnace of higher temperatures than those prevailing during the initial casting at the blast furnaces and an excess of air in the flame which may cause the choicest iron to turn out poor material.

Shrinkage of the hard castings is about one-fourth of an inch to the foot, or double that of gray iron. In annealing, about half of this is removed, hence the net result is the same as in ordinary pattern practice. The effect of this great shrinkage is to cause shrinkage cracks or sponginess in the interior of the casting. As soon as the liquid metal sets against the surface of the mold and the source of supply is shut off, the contraction of the metal in the interior as it cools causes the particles to be torn apart and to form minute cavities or cracks.

After the castings have been chipped and sorted they are packed in iron annealing pots, holding about 800 pounds of iron, together with packing composed of turnings, borings, etc. The turnings, etc. were formerly treated with a solution of salammoniac or muriatic acid to form a heavy coating of oxide, but such a treatment is now considered unnecessary. The effect of annealing is to oxidize and remove the carbon from the surface of the casting and to a greater or less degree below the surface, and to convert the remaining carbon from the combined form into the amorphous form, sometimes called a temper carbon. The heat in the annealing process must be maintained from 5 to 7 days, depending upon the thickness of sections of the castings and the compactness with which the castings or annealing boxes are placed in the furnace. An annealing temperature of from 1,550 to 1,600 degrees Fahrenheit is often used, but it is not essential, as the annealing can be ac-



Telpher Handling Load of Ore.

complished at 1,300 degrees, but the time required will be longer than that at higher temperatures.

After annealing, the castings are cleaned by tumblers and carefully examined for defects and if sprung or out of shape are hammered or forced into the proper shape. Such parts as are produced in great quantities are placed in a drop hammer and one or two blows will insure a correct form. They may be drop forged or even welded when the iron has been made for that purpose. Malleable castings must never be straightened hot, especially when thick. In the case of thin castings there is some latitude, as the material is so decarbonized that it is nearer a steel than genuine malleable cast iron. For general purposes it is not desirable to have malleable iron very high in tensile strength, but it should be high in transverse strength with especially good deflection.

The International malleable foundry is divided into several departments consisting of moulding room, hard room, annealing room, core room, pattern room and laboratory. The iron is poured into the molds from hand ladles. When cold the castings are removed with the aid of an electric traveling crane. There is a five-ton crane in the foundry and a crane of the same capacity in the annealing room. In explanation it may be said that the cranes consist of a bridge with the bridge motor only. There is a telpher system running from a single rail on both sides of the principle departments, the telphers, three in number, having a lifting capacity of five tons. The telpher hoists are operated by 10-horsepower, 220-volt direct-current motors and the traveler or means of propulsion by six-horsepower motors of the same characteristics. The crane bridges are operated by a similar type motor of 10 horsepower. By a combination of switches and turn tables the telphers are able to run out on the cranes and backward and forward between departments. There are four turn tables each operated by a 3-horsepower 220-volt, direct-current motor; the track switches are operated by motors of the same size and characteristics. There is a system of underrunning contacts adjacent to the telpher rails, also on the crane bridges so that all motors are under the control of the telpher operator.

Draft for the malleable furnaces is furnished by two No. 13 Sirocco blowers, each direct-coupled to a 35 horsepower, 2,300-volt, induction motor of the squirrel-cage type operating at a speed of 750 revolutions per minute. At one end of the foundry there is a group of machines consisting of two wet slag tumblers and a magnetic separator driven by a 10-horsepower motor with the same characteristics as the fan motors. This group of machines is used for recovering the iron from refuse the same as in the No. 1 plant.

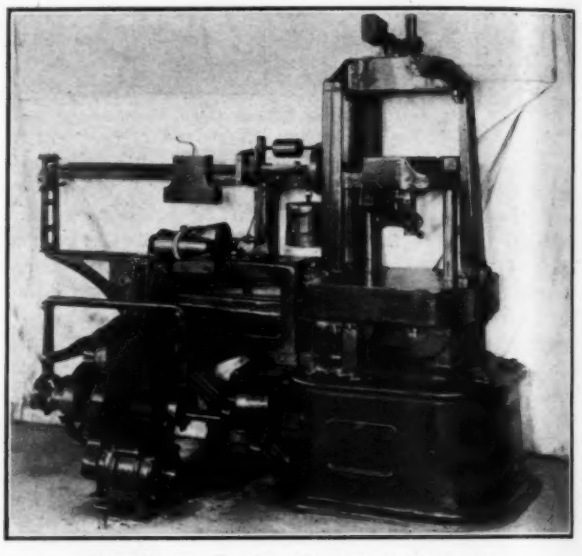
From the moulding room the castings are taken to the hard room where they are tumbled to free them from sand and the burrs and rough edges are ground off. In the hard room there are sixteen large tumblers, and six small tumblers group driven by a 35-horsepower 2,300-volt, squirrel-cage type induction motor operating at 750 revolutions per minute and equipped with a 13-inch pulley. The grinding equipment consists of four emery wheel stands with two wheels each, group driven by a 10-horsepower 220-volt motor of the same characteristics operating at 1,500 revolutions per minute and equipped with an 8-inch pulley.

Considerable attention has been paid to dust removal in the various departments. For the removal of dust in the hard room there is a five-foot exhaust fan direct-coupled to a 35-horsepower, 2,300-volt squirrel-cage type motor operating at 750 revolutions per minute. The dust is drawn through pipe connections from the tumblers and emery wheels to a large rectangular iron tank in which there are several cloth screens for collecting the dust. At stated intervals these screens are agitated by what is called a knocker, which is belt-driven by a one-horsepower, 220-volt induction motor.

From the hard room the castings are transferred to the annealing room where there are six annealing ovens with a capacity of 40 tons each. The ovens are heated by coal furnaces at the rear and use natural draft. The front doors of the ovens are composed of fire brick and steel, weigh approximately four tons each and are handled by the crane. The castings are packed in annealing pots as previously described and loaded into the ovens with a steam-driven loading truck. After annealing, the castings are again tumbled, straightened and chipped.

For tumbling, straightening and grinding the annealed castings there is a group of machines composed of one broaching press, one small bulldozer, one punch press, one two-wheel emery grinder, twelve 36-inch tumblers and two small tumblers. This group of machines is driven by a 35-horsepower, 2,300-volt, squirrel-cage, induction motor operating at 750 revolutions per minute and equipped with a 13-inch pulley. The broaching press is similar in construction to a punch but uses a tool similar to a round-headed mandrel and is used to correct irregularities in cored out holes in the castings. A second group of machines for further straightening castings is composed of four drop

Motor-Driven Fan for Malleable-Iron Furnaces.



Motor-Driven Testing Machine in Laboratory.

Harvesting Machine Manufacture Data—Sheet No. 1.

International Harvester Company (Osborne Works). Manufacture tillage implements.
Total connected horsepower, 1,079.5. Total number of motors installed, 44. Average kilowatt-hours per month, 143,952. Average kilowatt-hours per month per horsepower connected, 133.3.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 25 cycles, 2,300 volts and 220 volts, direct current. The direct-current motors which are used for cranes, elevators and telphers, are not enumerated herewith. Motors are of the squirrel-cage induction type unless otherwise mentioned.

No.	H.P.	Kind of Drive	Voltage	Speed R.P.M.	Pulley Size, Inches	Application
2	35	Direct	2300	750	..	Each driving a No. 13 Sirocco blower for furnaces.
1	10	Group	2300	1500	8	Molding Room.—Two wet slag tumblers; one magnetic separator.
1	35	Group	2300	750	13	Sixteen large tumblers; six small tumblers.
1	10	Group	220	1500	8	Four emery wheel stands, two wheels each.
1	35	Direct	2300	750	..	Hard Room.—Exhaust fan for dust collecting.
1	1	Belt	220	..	..	Hard Room.—Dust collector knocker for agitating screens in dust collector.
1	35	Group	2300	750	13	Annealing Room.—One broaching press; one small bulldozer; one punch press; one two-wheel emery grinder; twelve 36-inch tumblers; two tumblers.
1	20	Group	2300	750	10	Four drop hammers; two punches.
1	35	Direct	2300	750	..	Annealing Room.—Exhaust fan for dust collecting.
1	1	Belt	220	..	..	Annealing Room.—Dust collector knocker for agitating screens in dust collector.
1	5	Direct	220	1500	..	Core Room.—Fan for ventilating core ovens.
1	5	Belt	220	1500	8	Core Room.—Sand sifter.
1	5	Group	220	1500	8	Pattern Room.—One drill press; one small shaper; one emery wheel; one wood saw.
1	1	Group	220	..	..	Laboratory.—One small engine lathe; one paint grinder; one small drill press.
1	2	Gears	220	1500	..	Laboratory.—Olson 100,000-pound testing machine.
1	0.5	Belt	220	..	..	Laboratory.—Ventilating fan for chemical cabinet.
1	20	Group	2300	750	10	Two 12-foot punches; one 10-foot double punch; eight small punches.
1	35	Group	2300	750	10	One six-foot punch; two 10-foot punches; one 12-foot punch; five small punches; two straightening machines; one scrap shears; one drill press; two small shears; two medium punches; one header.
1	35	Group	2300	750	10	Five drop hammers; one welding machine; three spoke setting machines; one testing machine; two annealing furnaces; one drill press; one upright bulldozer; three bulldozers; one punch; one small drop hammer.
1	20	Group	2300	750	10	Three trip hammers; two eye benders; three punch presses; one drop hammer; one tire welder; one upsetting machine.
1	50	Direct	2300	750	..	Slip-ring motor driving Sirocco blower for furnaces.
1	50	Group	2300	750	13	Three punches; eight small drill presses; one riveter; two emery wheels; one threading machine.
1	75	Group	2300	750	..	Slip-ring motor driving eleven stands of two-wheel emery grinders.
1	20	Direct	2300	750	..	Driving 48-inch exhaust fan for removing dust from emery grinders.
1	50	Group	2300	750	16	Slip-rig motor driving two stickers; one wood riveting machine; one boring machine; one drop hammer; one band saw; one spoke machine; one sandpaper machine; one saw.
1	35	Group	2300	750	13	Two planers; one automatic feed rip saw.
1	20	Group	2300	750	10	Six cross-cut saws.
1	35	Group	2300	750	10	Two cross-cut saws.
3	35	Direct	2300	750	..	Three combinations of two 48-inch fans for removing shavings and sawdust.
1	35	Group	2300	750	13	Miscellaneous small woodworking machines.
1	15	Group	2300	750	13	One multiple-spindle boring machine; two single-spindle boring machines; one boring machine.
1	35	Group	2300	750	Special	Pole machine.
1	20	Group	2300	750	10	Three wood shapers; one special rip saw.
1	20	Group	2300	750	10	Two roll turners; two wood lathes; three cross-cut saws; two drill presses; three wood lathes.
1	15	Group	2300	750	10	One wood boring machine; one wood riveter; one tumbler barrel for small castings.
1	15	Group	2300	750	10	Four large paint grinders; two small paint grinders.
1	3	Gears	220	..	..	Pipe-threading machine.
1	35	Group	2300	750	13	One wood planer; two drill presses; one rip saw; one cut-off saw; miscellaneous small tools.
1	23	Direct	2300	720	..	Thirty-five-kilowatt direct-current generator 250 volts for cranes, telphers and elevators.
1	23	Direct	2300	720	..	Thirty-five kilowatt generator for 22-flaming arcs.
1	30	Belt	220	..	..	Slip-ring motor driving elevator in warehouse.

hammers and two punches. This group is driven by a 20-horsepower motor of the same characteristics as the former motor and is provided with a 10-inch pulley. It may be said that in some castings it is cheaper to punch certain holes than to core them out and the punch presses in this latter group of machines are used to a certain extent for this purpose. For collecting the dust from the various machines there is a duplicate equipment of that installed in the hard room.

Cores are placed in the molds to produce recesses, irregular shapes and holes in castings that would be impracticable to mold in the soft sand used in molding work. The cores are composed of hard sand and an adhesive mixture baked in ovens. The cores are as a rule formed in wood molds. In the core room of the malleable foundry there is a 5-horsepower 220-volt squirrel-cage induction motor direct-coupled to a ventilating fan for removing the gases from the coke in the furnaces and such gases as may be given off from the cores in the process of baking. Before making up into cores the sand has to be sifted and this is accomplished by a rotary sand sifter, belt driven by a 5-horsepower, 220-volt induction motor operating at 1,500 revolutions per minute and equipped with an 8-inch pulley. Brass patterns are principally used and the pattern room has an equipment of one drill press; one small shaper; one emery wheel, and one wood saw driven by a five-horsepower motor with the same characteristics and the same size pulley as that driving the sand sifter.

There is a fully equipped laboratory in connection with the malleable foundry for the testing of raw and finished products of all kinds, not only chemically but mechanically. The equipment includes one small engine lathe; one paint grinder, and one small drill press, group driven by a one-horsepower, 220-volt squirrel-cage induction motor. For testing the tensile strength of metals there is an Olson 100,000-pound testing machine geared to a two-horsepower, 220-volt, squirrel-cage induction motor. There is also a one-half horsepower 220-volt induction motor direct-connected to a small exhaust fan for exhausting the fumes from the chemical cabinet. The electrical equipment of the malleable foundry is concluded with an Otis push-button control elevator operated by a 10-horsepower, 220-volt, direct-current motor. This elevator is used for carrying the patterns to the pattern storage on the upper floors of the foundry building.

The shear and punch shop next demands attention. Here the parts of the frames and the tires of the wheels for some of the machines are punched. The tires are first flat strips of metal and the multiple punches make all the holes for receiving the spokes, and punch the required number of holes in part of a frame at one operation. There is one group of two 12-foot punches; one 10-foot double punch and eight small single punches driven by a 20-horsepower, 2,300-volt, squirrel-cage induction motor operating at 750 revolutions per minute with a 10-inch pulley. The large punches are provided with a number of punches and dies for the simultaneous punching of a number of holes. The seemingly small power requirements for such large machines is explained by the use of heavy fly-wheels on the punches. These fly-wheels have sufficient momentum to smooth out what would under ordinary circumstances, be a series of severe peaks on the load curve. There is a second group of punches and shears and some miscellaneous machines for carrying on the operations of punching holes, cutting up the material in desired lengths, etc. This group is driven by a 35-horsepower, 2,300-volt, squirrel-cage motor with a 10-inch pulley and operating at 750 revolutions per minute.

In the harrow shop, as the name implies, the various parts of the harrow are made. It will be unnecessary to enumerate all of the machines in this department as they are given in the accompanying table. Some of the machines possess more than ordinary interest, however, such as the machine for welding the wheel spokes into the tires and hubs. Each spoke is heated at the ends in a furnace and placed in the proper position in the wheel when the machine automatically upsets the heated ends and in reality rivets the spoke in place. The harrow teeth are of several shapes, some are in the form of large spikes. The heads on this style of teeth are made from the stock itself by means of the upsetting machine. The harrow disks, that is the parts that cut up the earth, are received from an outside steel company but are ground in one of the harrow shop departments. The grinding is performed on eleven stands of two-wheel emery grinders. The motor drive for these grinders is novel from the fact that the motor is direct-coupled to the line shaft driving the grinders. It is rated at 75 horsepower, is the slip-ring type and operates at 750 revolutions per minute. For removing the dust from the emery grinders there is a 48-inch exhaust fan direct-coupled to a 20-horsepower, 2,300-volt, squirrel-cage motor operating at 750 revolutions per minute.

The forced draft for the heating furnaces is furnished by a Sirroco 8-foot blower direct-coupled to a 50-horsepower, slip-ring, 2,300-volt motor operating at 750 revolutions per minute. A 35-, a 20- and a 50-horsepower motor all rated at 2,300 volts and 750 revolutions per minute make up the balance of the motor equipment in this department.

In the wood shop all of the wood parts of the various machines are turned out. The building is four stories in height, three of the floors being occupied by the woodworking machinery and the fourth by the painting department. There are 12 motors in the wood shop with the same general characteristics as those in the other departments, as shown on the motor data sheet. All refuse from the machines is removed by motor-driven exhaust fans and deposited in a separate building.

All paint used by the International company in this plant is made in the paint shop which has an equipment of four large and two small paint grinders. These machines are group-driven by a 15-horsepower, 2,300-volt, squirrel-cage induction motor with a 10-inch pulley and operates at 750 revolutions per minute. There is a repair shop and a plumbing shop with a miscellaneous equipment of machines for general repair and maintenance work all of which are group driven with the exception of a pipe-threading machine which is geared to a three-horsepower motor.

Louisville Electric Sign Combines Weather Forecast with Advertising Message.

An electric display which is attracting a good deal of favorable attention in Louisville is a weather-forecast sign which is in use in front of the Newman Drug Company. It is a shield-shaped sign, red enameled, with the name of the company and the word "Drugs" set out in 12-inch lamp-studded letters.

Just below, arranged in three columns of two, are the words, "Fair," "Rain," "Warmer," "Colder," "Wind," and "Snow." The weather is indicated by a lamp burning in front of any of these words.

Each day the company receives the official forecast from the Weather Bureau and indicates the weather probabilities by lighting the proper lamp or lamps by means of switches, one to a lamp.

Civil Service Examination.

The Civil Service Commission of the state of New York has announced an open competitive examination to take place on December 11 for filling positions in the state, county and village service. Among the positions for which examinations are to be held are junior engineers at salaries of from $1,200 to $1,500, junior assistants in the engineering department at salaries from $900 to $1,200, junior draftsmen at $900 to $1,200 and structural draftsmen at $1,200 to $1,500.

Commercial Practice
Management, Rates, New Business

Electricity Used for Lighting Monster Birthday Cake.

Lighting of a birthday cake is a novel use of electricity made at Columbus, O. The cake weighed almost half a ton. It was baked in celebration of the thirty-fifth anniversary of the opening of Max H. Rieser's store, a ladies' ready-to-wear establishment. This custom has been followed by Rieser's for several years, the cake being made larger for each occasion. This year electric candles were substituted for wax, in the interest of cleanliness and safety. Steel conduit for carrying

Birthday Cake Illuminated by Electric Candles.

the wires was baked into the top of the cake, and covered with icing. Attachment to the supply source was made through the regular electric fixtures in the show window where the cake was placed on exhibition. Thirty-five candles, the symbolical number, were used, connection being made through sockets ornamented with icing. The candles were about five inches high, with perpendicular frosted globes. The cake was 4.5 feet high, 15 feet in circumference and 3 feet thick. Materials required in its creation were: One barrel of flour, one barrel of sugar, 1,000 eggs, three tubs of butter, 50 quarts of milk, one quart of lemon flavor, one quart of vanilla flavor, 225 pounds of icing. The cake, which required the services of six men to bake, was hauled by motor truck from a Columbus pastry shop to the store, accompanied by the six bakers, over a parade route, October 30, and placed on exhibition. On Saturday, November 5, the mayor of the city cut the cake.

Suggestions for Central-Station Advertising Managers.

That the average central station has about reached the turning point in its economic development, and henceforth must depend as much upon a judicious use of a sufficiently large advertising appropriation as it has heretofore depended upon the careful investment of its resources in equipment and operation, was the opinion voiced by J. J. McManus in a paper before Southern central-station men at a recent convention.

In order to show what might be done preliminary to establishing an advertising policy, in launching a continuous campaign for the future, the author gave the following outline of suggestions that might be profitably followed out by the central-station advertising man.

(1) Analysis of the city as a whole as to races, classes, incomes, class of business, etc.

(2) Dividing city or territory into districts according to above classifications.

(3) An estimate of the possible business to be derived from each district.

(4) Possibilities of extending new service.

(a) Unwired houses—number in the city, possible income from each.

(b) New buildings contemplated, number, etc.

(5) Possibilities of obtaining greater saturation on present lines.

(a) Analysis of light load.

(b) Analysis of power load.

(c) Analysis of heating devices load.

(d) Comparison of these three loads and the relation to the total load curve and the advisability of increasing the saturation along any one or all lines.

(e) Study of revenue received from present customers compared with the possible revenues they could afford, providing they could be induced to use more current.

(6) Investigations and compilation of active mailing lists.

(a) For customers—divided as to lighting customers, power customers, devices customers and combinations of these three.

(b) For those not customers—divided as to possibilities for lighting and devices, and for power.

Commercial Laundries Boost Electric Irons.

Appliance dealers in Louisville, as well as elsewhere, report that they are getting some support in their sales of electric irons from a source that was regarded as inevitably hostile. It would naturally be expected that the owners of laundries would oppose any device that would tend to make washing of clothes at home easier. On the other hand it has developed that the laundry owners are in favor of the electric iron and credit a good deal of increased business to this appliance, which has furnished a contrast with the laborious methods of washing clothes. So in numbers of cases the housekeepers are ridding themselves of a weekly bugbear by sending their work to the laundries to be returned "rough dry," finishing it up at their leisure.

THE SALE OF CURRENT TO MUNICIPALLY OWNED DISTRIBUTING SYSTEMS BY CENTRAL STATIONS.[1]

By W. Rawson Collier.

The subject of the sale of current to municipally owned distributing systems by central stations is a comparatively new one, at least in the southern section of the country. Two facts have tended to make this class of business an extremely important one durthe past few years. First, the very rapid growth of hydroelectric distributing systems, and, second, the large number of municipally owned electric light plants and water-works systems. As the hydroelectric companies gradually extended their transmission lines, they were confronted with the difficulty of being unable to sell their product in towns where municipal lighting plants and municipally owned water-works systems were in operation, on account of the fact that the cities owning these plants were unwilling to grant the power companies a general franchise to enter the town for fear that they would prove a serious competitor, in the eiectric lighting and the electric power situation. The only way that the power company therefore could possibly sell its products to the citizens of the town was through the municipally owned systems, and for this reason the business was approached from this standpoint.

In Georgia today there are approximately 80 municipally owned electric lighting plants and practically all of the towns in the state own and operate their water-works systems. Of these approximately 35 are within reach of the transmission lines of the four large hydroelectric companies operating in Georgia and 26 of those within reach of the lines are now being operated electrically with energy purchased from the hydroelectric companies. In every case the purchase of current has proven a good investment to the town and in almost every case the citizens are more than well pleased with the service that they are obtaining.

In one case, a town that had lost $17,000 in operating its steam-electric generating station for three years, began to show a profit as soon as the current for lighting and operating its electrically driven pumps was purchased and today shows a profit of between $600 and $800 per month on the operation of its municipal lighting lines and electrically operated water-works system. Another town in question was losing money at the rate of approximately $3,600 per year in operating its steam generating station, and this loss was changed to a profit of approximately $3,000 per year by abandoning the steam station and purchasing current from a hydroelectric company.

In studying the question of selling current to municipally owned electrical distributing systems and municipal water-works systems, the writer has found that it is extremely hard to determine exactly what the requirement of one town will be by comparing the town under question to other towns on which exhaustive data have been obtained. The accompanying plots illustrate to a very great extent the irregular characteristics of various towns in so far as the kilowatts connected, maximum demand and kilowatt-hours use per year, per 1,000 white population is concerned. For general information, however, they serve for comparison, and as submitted herewith will be found of considerable interest and also of considerable value in figuring with prospective customers. The data cover twelve towns, and the general characteristics of the town under discussion are as follows:

TABLE I.

Town.	Population.	General Characteristics.
A	6,600	Resident town. Little power sold.
B	4,900	Competitive situation. Water works machinery electrically operated. Considerable other power sold.
C	4,800	Water works machinery electrically driven. Considerable small power sold. A live town.
D	4,670	Water works machinery electrically operated. Very little small power sold.
E	4,250	Water works machinery electrically operated. Considerable small power sold. A live town.
F	3,000	Water works machinery electrically operated. Only a small amount of power sold.
G	2,000	Water works machinery electrically operated. Considerable small power sold. A live town.
H	1,870	Practically no small power sold. Only lights.
I	1,200	Water works machinery electrically operated. Very little other power sold.
J	1,200	Water works machinery electrically operated. Some small power sold. A live town.
K	935	A residential town. Practically no power sold.
L	650	Practically no power sold. Lights only.

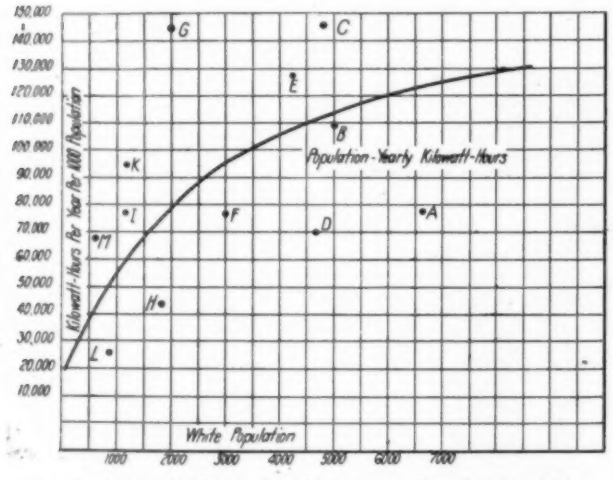


Fig. 1.—Kilowatt-Hours Per Year According to Population.

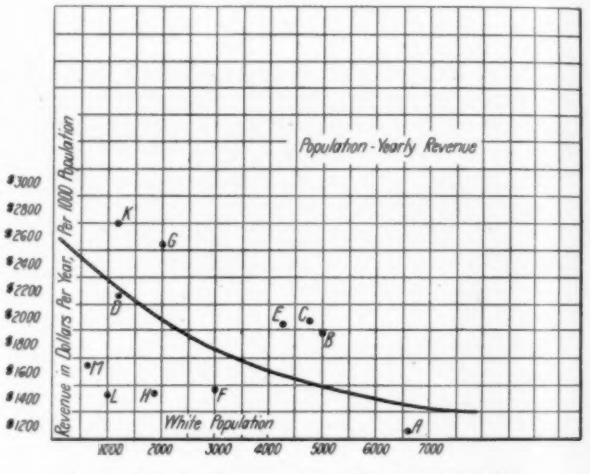


Fig. 2.—Yearly Revenue According to Population.

By referring to Fig. 1 it will be seen that towns A, D, F and H are well below the average line. In none of these towns does the superintendent of the municipal lighting system make any very good attempt to solicit power business and a study of their daily load curves shows that there is practically no demand for power between the hours of 1 a. m. and 3 p. m., practically all of the load being caused by the lighting demand, which comes on at about three o'clock and in the afternoon laps with the pumping load until about one o'clock in the morning.

The town E, which it will be noted, is considerably above the average line, is a town where the operating superintendent has worked up very considerable power business, and where a great deal of time has been spent by him in

1 From a paper presented at the recent convention of the Southeastern Section, N. E. L. A.

soliciting heating devices, such as flat irons, etc. It will be noted in this plot that the town B practically falls upon the average curve. This town, although it represents a competitive situation where a privately owned plant is competing with the municipally owned plant still represents a very healthy condition. A large amount of power has been obtained by the superintendent of the municipal plant in this town, and in addition to the ordinary small manufacturers' load, the town carries two or three cotton gins through the ginning season. This town's consumption per year is also increased by the fact that it is necessary for it to obtain its water from a number of driven wells, and it is necessary to operate a large air compressor often for as many as ten hours per day, during the dry season. This town in question charges against itself all operating expenses of the water-works system at actual cost, and its books show a handsome profit on the sale of water after all operating and overhead expenses are deducted at the end of each month.

Fig. 2 shows the relation of the yearly revenue to the population (white) of the towns as mentioned in Table I. It will be noted that many of the towns appearing above the average load line in Fig. 2 are those which appear above the average line in Fig. 1, with the exception of town M, which has only been in operation less than one year and previous to the making of the contract with this town, no electric lights were furnished to its citizens at all. It has been found that Fig. 2 is very nearly accurate, and this plot has proven extremely valuable in figuring on the advisability of taking on the business in certain towns, as it has given a very fair estimate of the revenue to be expected if a certain amount of money has to be expended for lines, transformers, etc., in order to make the necessary connection.

Fig. 3 is an extremely interesting study if taken in connection with the table and in connection with Fig. 1 before mentioned. By studying this plot the effect of exclusive lighting customers can quickly be observed. Take, for instance, the town A in Fig. 1, it will be seen that the yearly kilowatt-hours for 100 population is well below the average, while by studying Fig. 3 it will be seen that the kilowatts of maximum demand per 1,000 population is above the average line. This is due to the fact that town A is practically a residence town. It has a very high peak, and the average load-factor is extremely low. The same is true of the town F, which is below the average curve in Fig. 1, but above it in Fig. 3. It has been found that the town with a large amount of small power and with a considerable lighting and pumping load—that is, a town with a poor diversity-factor, such as towns G and C, can be expected to show up above the average line both in kilowatt-hours per year per 1,000 population and in kilowatts of maximum demand per 1,000 of population. This on account of the fact that it is often necessary for the superintendent to operate the water-works pumps and the air compressor at the same time that his regular power customers are operating their factories, gins, etc.

Fig. 4 shows the results of a very careful study on the operating costs of the various municipal plants using their steam generating station and the operation of these same municipal plants after they had begun to purchase current from a central station. It will be noted that the two curves are very similar, and that they remain approximately the same distance apart throughout their entire range. The central-station operation shows a little greater advantage as the towns grow larger and the number of kilowatt-hours per year increases. It might be mentioned that these curves represent the total cost of current at the switchboard in each case.

Fig. 5 shows the variation of the average cost per kilowatt-hour per year with the yearly load-factor, and illustrates very closely the very great advantage held out to the local superintendent in increasing his load-factor by the addition of small power, heating devices, etc., and by the proper operation of his electrically driven pumps and air compressor with a view of keeping down the peak and increasing the daily load-factor. The lower figure in Fig. 5 shows the decrease in cost per kilowatt-hours to the customer with the increase of yearly kilowatt-hours. This curve it must be noted is only an average curve, due to the fact that the yearly load-factors of the various towns vary considerably, and, therefore, it is possible for two towns that are using the same number of kilowatt-hours per year, but with different load-factors, to have a different average cost of current per kilowatt-hour.

In order that this article may be of some assistance to the various companies in the soliciting of the business of furnishing current to municipally owned lighting systems, it will be interesting to make a slight study of conditions as they may exist at present in typical plants in the northern section of Georgia. Fig. 6 shows a typical daily load curve of three somewhat similar towns. These towns are practically of the same size, but vary considerably in general conditions. Town A has a fair amount of residential and commercial lighting, a very good system of street lighting, electrically driven water-works pumps, electrically driven air compressors and obtains its water supply from seven driven wells. These wells have given the town a great deal of trouble and during the dry season the supply of water is very

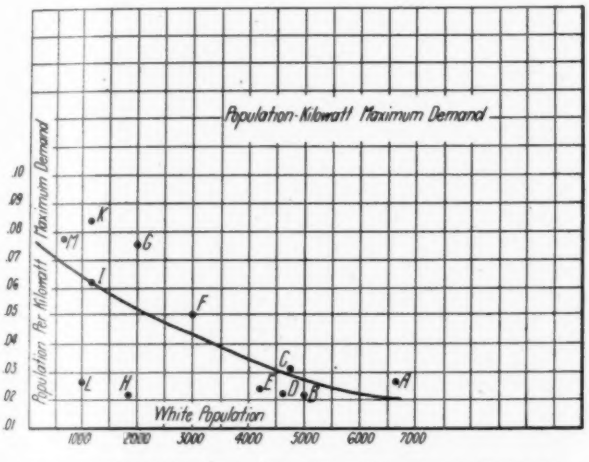


Fig. 3.—Population Per Kilowatt of Maximum Demand.

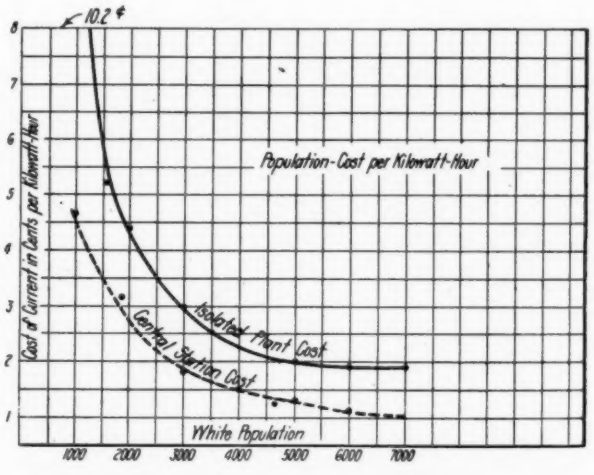


Fig. 4.—Unit Costs Per 1,000 Population.

limited. For this reason it is found necessary to often operate the air compressors during the night and for four or five hours during the morning. It will be seen by a study of the load curve covering this town that the air compressors operated from 9 p. m. until approximately 6 a. m. This town has a small amount of commercial power, but this business has not been fully worked up. Town B represents a somewhat similar case; that is a town with a good residential and commercial lighting load, a very fair street-lighting load and both electrically driven water-works pump and electrically driven air compressor, the supply of water being obtained from driven wells. In this town trouble has also been experienced with obtaining a sufficiently large enough supply of water from the driven wells and here also it becomes necessary, as may be seen from the load curve, to operate the pumps through the night and the compressor from 9 a. m. until 2 p. m., and frequently during the summer the compressors have been operated from 10 p. m. until 10 a. m.

Town C well represents the average town in Georgia getting its water supply from a creek or river, using electrically driven water-works pump and supplying a fair residential and commercial lighting load with a small amount of power. In this town the water-works pump is operated only between midnight and four o'clock, and the load as shown from 6 a. m. until approximately 1 p. m. represents small printing presses, dental motors, fans, ice cream freezers, etc., operated from the municipal system. The daily load-factor could be considerably increased in this town by the proper soliciting of power business by the superintendent in charge and the increase of this load-factor would decrease the average cost of current to the town per kilowatt-hour. This town could easily increase its load-factor from approximately 30 per cent to approximately 45 per cent by the addition of the proper power load during the day and by this increase could decrease the average cost of current from approximately 1.92 cents per kilowatt-hour to approximately 1.65 cents per kilowatt-hour.

TABLE II.

Average demand (kilowatts)	26
Kilowatt-hours per day at average demand	624
Kilowatt-hours per day if maximum demand used 24 hours	2,424
Load factor (per cent)	25.7
Horsepower maximum demand	134
Value of machinery	$6,700
Interest and depreciation (17 per cent)	1,139
Loss in interest and depreciation account idle-factor	846
Interest and depreciation charge per kilowatt-hour actual	.005
Interest and depreciation charge per day	3.13
Coal, fireman, incidentals, interest and depreciation, per kilowatt-hour	.0268

In soliciting the business of municipally owned electric light plants it has been found by the writer that the average city councils or the average city superintendent has never taken into consideration or did not desire to take into consideration the enormous loss to the city of idle investment due to low load-factor, this being particularly true in steam generating plants.

By means of data in Table II, it was found that it was a comparatively easy matter to bring home to the city councils the fact that by the non-use of their steam plant throughout the greater portion of the day, they were actually losing a great deal of money, and that this loss was no where nearly as great if they purchased power from a central station, as the central station sold its current as a finished product at the switchboard. In a number of cases this plot has practically been the argument that has decided the city council in favor of the purchase of current rather than the manufacture of it, and no doubt this scheme can be used to a very great advantage by companies, not only in the soliciting of business of steam-driven municipal plants, but also in the soliciting of isolated plants throughout their territory.

One serious drawback has been found in selling current to municipally owned distributing systems in the South. The Southeastern Underwriters Bureau gives a certain credit to a town for maintaining steam under the boilers at all times, so that the steam fire pumps can be operated at a moment's notice in case of a serious fire. The association considers that with an electrical pump it is necessary for the town to also maintain, at all times, a reserve unit in the shape of a steam-driven pump, with banked boilers. The only substitute that the Underwriters' Association will accept in lieu of a banked boiler and an Underwriters steam pump is a duplicate line from the generating plant of the hydroelectric company to the substation of the town and one overhead and one underground connection to the electric fire pump from a pole placed a considerable distance from the pumping plant, if the cut in wires parallel and are close to any building that would constitute a fire hazard, also the lines from the company's step-down substation to the pumping plant must be a duplicate, if the substation is not a fireproof structure. There are only a very few cases where this duplicate line can be built by the hydroelectric company, on account of the expense, therefore it has been found necessary in a number of cases to have the town maintain its boilers and keep them banked at all times, although it was purchasing all of its energy from a hydroelectric company. In some cases the expense of banking the boilers has been borne by the town and in other cases the expense is borne totally or in part by the hydroelectric company selling current to the town.

It has been found that the average cost of coal for banking boilers in the small towns in this territory is approximately $1.35 to $1.50 per day. No labor is charged against this item, as it is generally desired to have a man on

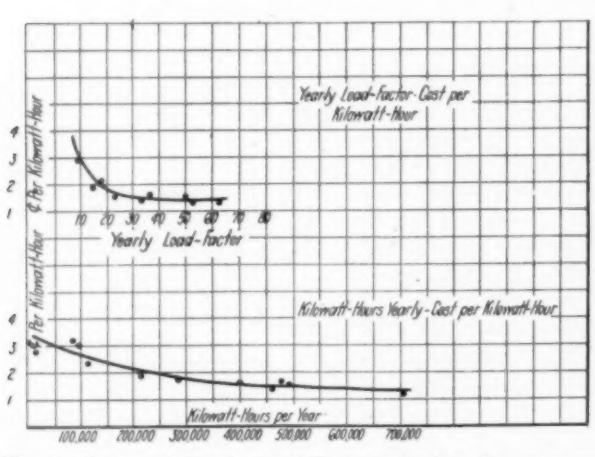


Fig. 5.—Curves of Yearly Load-Factor and Cost Per Kilowatt-Hour.

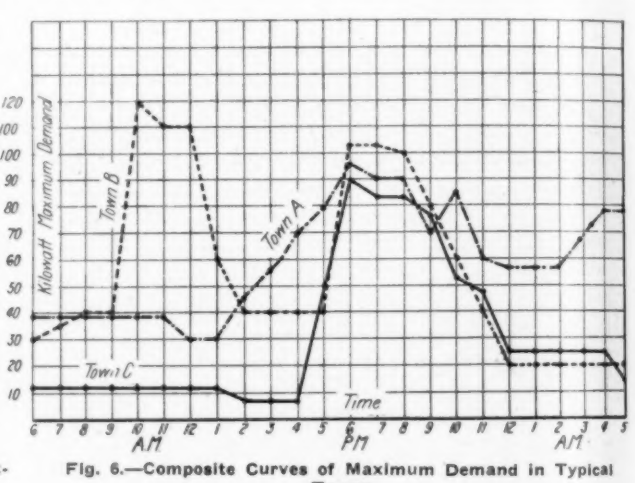


Fig. 6.—Composite Curves of Maximum Demand in Typical Towns.

duty at the plant at all times, with the view of regulating the voltage, operating the service pump and the air compressor, and in case of need, operating the electrically driven Underwriters pump. It has been suggested that an auxiliary pump, operated either by a gasoline engine or an oil engine, be used in place of banking the boiler, but to date such a substitute has not been approved by the Underwriters' Association.

The company with which the writer is connected has been operating municipal plants now, in approximately 20 towns, for 18 months, but so far there has never been a single failure in the operating of the Underwriters electrically driven fire pump in case of an emergency. The writer therefore feels that the rule, as passed by the Underwriters, works a hardship, not only on the town in question, but on the company furnishing current to the town, and it is hoped that within a few years the hydroelectric companies can show such a clean record in the way of continuous operation that the rule as it now exists will be entirely done away with.

In passing, it might be stated that the Georgia Railway & Power Company sells energy to municipally owned distributing systems in the shape of 2,300-volt, three-phase, 60-cycle energy delivered at the switchboard. The company furnishes the necessary step-down transformers generally from 22,000 to 2,300 volts, the necessary lighting protection and disconnecting switches and brings the 2,300-volt connection to the customer's board. The customer provides an incoming panel with suitable instruments mounted thereon and the necessary 2,300 oil-switch controller panel for the arc circuit, the commercial circuit and the operation of the electrically driven pump and compressor. The cost of such equipment to the town is comparatively low and varies to a very great extent with the demands or desires of the town.

As a general proposition, it is often necessary for the town to buy electrically driven fire pump and an electrically driven service pump, together with electrically driven compressors, but in several towns where a complete change has been made it has been found that the total cost to the town, including the compressor, service pump, fire pump and necessary switchboard with all necessary pipings and foundations, did not exceed $3,000. In some cases, on account of line regulation, it becomes necessary for the hydroelectric company to furnish and install in the customer's station an automatic regulator, and in this case the cost of installing the regulation is borne by the company furnishing the current and the losses in the regulator are then automatically deducted from the customer's monthly bill.

Two Views of Electric Show Held by the Benton Harbor-St. Joe Railway & Light Company.

Texas Company Encourages Dealers to Form Christmas Clubs to Stimulate Appliance Business.

The Texas Power & Light Company is sending out to all contractors in its territory the following circular letter together with a proposal on a special iron exchange for "Electrical Prosperity Week."

This Christmas Club idea is one which should prove popular to the buying public and when coupled with "Electrical Prosperity Week" is sure to make an impression and sell a great many appliances.

Many times you have heard of the Christmas saving club plans which many banks have used with good success in getting deposits and starting new accounts.

You have a chance right now to take advantage of this lession which the banks have taught us, by starting an "Electrical Appliance Christmas Club" in your own store.

By starting this club on the first day of "Electrical Prosperity Week" you can make it last four weeks. The following plan is outlined as being applicable to your business:

A payment of 50 cents each week for the four weeks will entitle the customer to a $2.00 appliance during Christmas week. A 75-cent payment each week will entitle the customer to a $3.00 appliance during Christmas week. A $1.00 payment each week will entitle the customer to a $4.00 appliance during Christmas week, and a $1.25 payment will entitle the customer to the choice of any $5.00 appliance during Christmas week, or if you prefer you can offer a small bonus and give the customer a little bit more than they pay for during the four weeks, that is, you could give the customer making a 50-cent payment each week a $2.50 appliance, the one making a 75-cent payment each week a $3.50 appliance, etc.

It would add to the publicity end of this club if you would offer a prize of some kind, say an electric percolator to the person purchasing the most appliances during the month of December. This would stimulate action, and would undoubtedly bring most of the trade to your store.

Think this over, and decide to put the plan in action.

Get up an attractive window display announcing this Christmas club plan.

If you want any assistance or further ideas on this proposition we will be glad to supply same.

Electric Show in Benton Harbor.

The accompanying illustrations show two views of the electric show recently held in Benton Harbor, Mich., under the auspices of the Benton Harbor-St. Joe Railway & Light Company. In addition to the central station, several manufacturers maintained exhibits, the total space so used aggregating over 5,000 square feet. The attendance exceeded expectations by several thousands and it is believed by J. A. Cavanaugh, superintendent of light and power, who planned the exhibition, that the show will give decided impetus to electrical development locally.

Electrical Construction

THE TEMPERATURE OF FIELD WINDINGS.

By H. M. Phillips.

Why is it that a manufacturer of electrical apparatus, specifically dynamos and motors, apparently prefers to bid on specifications, or to so write his guarantees that a competitor with a decidedly inferior line of goods is placed on terms of equality with himself? This does not appear to be a reasonable condition of affairs, but it is the essential fact in more than one particular, notably in regard to temperatures and particularly the temperatures of shunt-field windings.

Examine the bulletins and other printed matter issued by the leading manufacturers: two points can hardly escape attention; they deal almost entirely in generalities, and are all very much alike. There will be one or more cuts that give a more or less accurate idea of the external appearance of the machine, but the reading matter might very well be condensed into one sentence, "We build motors," which, after all, is probably about all the information they are intended to convey. The salesman will go much further, particularly with verbal information, but when asked for written "performance guarantees" the similarity of the various makers is again very pronounced. The writer has heard (it may not be true) of one manufacturer who showed originality by obtaining the efficiency guarantees of a competitor, and without further ado made his own two per cent higher on his entire line of motors.

The temperature of electrical apparatus is a vital point, and the guarantee almost invariably corresponds very closely if not exactly with the limiting temperature recommended in the Standardization Rules of the American Institute of Electrical Engineers. Now there can be no possible doubt that in the majority of cases a motor, or generator, that runs considerably below the limiting temperature is decidedly preferable to one that goes up to the limit. Why is it that a manufacturer who knows that his motor will run cool will give no better temperature guarantee than one who knows his will run hot?

The latest edition of the Standardization Rules, July 1, 1915, treats in a very instructive manner the taking of temperatures, as well as numerous other essential points in regard to standard electrical machinery; it is well worth reading. In reference to temperatures, directions are given for the use of thermometers and the method of estimating temperature from the increase of electrical resistance. It then assumes that the usual fibrous insulating material, untreated cannot safely be allowed to exceed a temperature of 95 degrees centigrade, but that by impregnating or other special treatment the limit can be raised to 105 degress. This temperature should not be exceeded at the hottest spot in the insulation, and as it is obviously impossible to reach that spot with a thermometer or to measure the change in resistance of that portion of the conductors in immediate contact with that spot, it is assumed that 15 degrees must be added to a thermometer reading and 10 degrees to the value calculated by change of resistance. On the assumption that the temperature of surrounding air is not likely to exceed 40 degrees centigrade, unimpreganted windings are allowed a temperature rise of 40 degrees by thermometer or 45 degrees, by resistance measurements, 10 degrees being added to these figures for impregnated windings. No recommendation is made as to the choice of the two methods of measurement, except that "the resistance method shall not be used on low-resistance coils where joints and connection form a considerable part of the total resistance."

For general purposes these rules are doubtless the best that can be devised at the present time and they are apparently excellent for large motors or medium-size generators of standard construction; but for such motors as are ordinarily used on machine tools and for various "freaks" they are, in the writer's opinion, somewhat inadequate. Why is it that the large majority if not all of the manufacturers specify that temperatures are to be taken by thermometers? In some cases the reason is very evident; the allowable temperatures would be greatly exceeded if measured by the rise in resistance; but why does the manufacturer whose machines could stand this test put himself on the same level with his competitor whose machines will not?

Experience has demonstrated that it is very difficult to measure armature resistances with sufficient accuracy to obtain reliable results in regard to temperature rise and that when this is done the results are generally not more than five degrees higher than the thermometer measurement, which is a very good reason for using the latter. The same is also generally true for the compounding on a direct-current machine and for the winding on commutating poles. It is generally less difficult to measure the resistances of induction motors, but, from the nature of their windings, comparatively thin layers imbedded in iron, the thermometer method is generally sufficiently accurate. The field winding of a series motor may be difficult to measure, on account of its low resistance, but the thermometer is of doubtful accuracy. The shunt motor has a field that is easily measured and on which in very many cases the thermometer is almost useless.

In the shunt field, heat is developed at a practically uniform rate throughout the length of the winding and must, if the run is continued till constant temperature is attained, be carried away from the surface of the coil at the same rate at which it is generated. The surface, where the thermometer is applied, is necessarily the coolest part; some part of the interior has the maximum temperature, on which the life of the insulation depends; while the calculation from the change in resistance gives something approaching an average temperature. It is interesting to examine a few of the cases, for all of which the assumption is made that the hottest spot is 15 degrees higher than the thermometer reading and 10 degrees higher than the temperature calculated from the resistance.

The generator of moderate size has a comparatively thin field coil, or the coil may be wound in concentric sections with ventilating space between; the wire is quite heavy; there are probably not more than three or four layers in a section and the coil has no outer covering. In this case there will probably be less than five degrees difference in the two methods of measurement and it is likely that both are

within 10 degrees of the real maximum temperature. Take the 5- or 10-horsepower, 220-volt motor commonly used on machine tools; the field coil is probably as thick as that of the generator previously considered, it is not wound in sections, there are a large number of layers of fine wire, and the heat generated in the center must traverse a considerable mass of insulating material before it reaches the surface of the coil; there it meets one or two layers of insulating tape, or perhaps first a layer or two of stiff paper, before it reaches the thermometer. It is rather surprising that a large number of such motors show only from 6 to 10 degrees higher temperature by resistance than by thermometer; if the tester can introduce the bulb of his thermometer between the outer tape and the winding he is likely to reduce the difference by several degrees. If the same motor is wound for 500 volts, finer wire and more layers must be used, the wire may also be more heavily insulated and special attention paid to tapeing the outside; all of which will increase the difference between the hot spot and the surface.

On the same motor let us consider a compound winding; if the motor is small the manufacturer may not care to go to the expense of a separate coil; the shunt coil will be made with less depth but of still finer wire; it will be taped, with an extra thickness or two of heavy paper added; the series winding will be wound directly on this, and the whole taped once more. If the series winding is liberally proportioned the resistance measurement may show 20, 30 or even 40 degrees higher than the thermometer.

In the preceding paragraphs it has been assumed that the temperatures are measured after the coils have reached constant temperature, which for ordinary motors means a full load run of at least four hours, while some may require eight hours or longer. The majority of machine-tool motors are sold on a two-hour rating, while some are rated for 30 minutes or even 15; this allows a decidedly greater input of energy for the field coils and a corresponding increase in the difference of temperature between the inside of the coil and the surface. There are also numerous and very erratic variations produced by the circulation of air currents from the armature and the amount of contact which the coil has with the surrounding metal frame. There is no possible doubt that many motors would burn out if their fields approached the temperature, by thermometer measurement, allowed by the Standardization Rules and by the makers' guarantees; as the maker desires a reasonable life for his machine, those that show a large difference between the thermometer reading and calculated temperature will generally have a rather low temperature rise by thermometer.

Some manufacturers claim that results obtained by the resistance method are inconsistent, unreliable, and change from day to day. In one instance in the writer's experience tests were cited where on successive days the results differed by 2.5 degrees as a proof of inaccuracy; but two thermometers placed a very small distance apart on the same coil and at the same time showed a difference of four degrees. As a matter of fact, the calculated temperatures are usually much more consistent than the thermometer readings, provided resistance measurements are taken with the moderate degree of care that should be the rule rather than the exception on all test floors. Variations of two or three degrees are bound to occur from day to day, but they are more likely to be on account of some slight change in the ventilation of the room, or to other atmospheric conditions causing a real difference in the temperature of the coil, than to error in the result obtained. Two motors which are supposed to be identical in construction and show the same temperature rise by thermometer, while the calculated temperatures vary by several degrees, might be taken to show the superiority of thermometers; but this does not necessarily follow. If the coils of the two motors take the same current they must radiate equal quantities of heat and their surfaces will be at the same temperature; this will not be materially changed if one coil has a little closer wrapping of tape than the other, an extra sheet of paper under the tape, or a greater amount of varnish in the windings; but such changes may make quite a material difference in the temperature of the interior of the coil. A case has been observed where five tests were conducted on the same machine without in any way disturbing the thermometers from the position in which they were originally placed. On four tests the calculated temperatures checked very closely and on three the thermometers did also; on the fourth the thermometers, four in number, all gave a reading several degrees low; on the fifth test both thermometers and calculated temperatures were several degrees lower than on the three tests that agreed. It is evident that on the fifth test there was a real change of temperature due to atmospheric conditions, but the low reading of thermometers while the calculated temperature did not change apparently indicates an error in thermometer measurements due to some condition that could not be determined at the time of test.

It hardly seems possible that a manufacturer whose motor was so poor as to fail to meet the A. I. E. E. requirements by thermometer measurement would deliberately make it worse; but suppose a motor on a 30-minute or two-hour test showed an excessive field temperature; a few layers of paper or other heat-insulating material placed underneath the tape on the field coils would probably give satisfactory thermometer readings.

Electrical Installation in Seattle Warehouse.

A new warehouse has recently been constructed in Seattle, Wash., by the Seattle Terminal Company for Sears, Roebuck & Company. The electrical work in this building was installed by The White City Electric Company, of Chicago, Lyle D. Grey being superintendent of construction.

The building is 285 by 310 feet in size and nine stories high. There is also a 12-story tower. Reinforced-concrete construction was used, the building being faced with red pressed brick with a white terra-cotta trim.

Energy will be supplied by the Puget Sound Traction, Light & Power Company from a two-phase circuit. A transformer platform has been made a part of the building and is erected over an outdoor loading platform. The switchboard is located in the basement beneath this. A specially designed pull box incloses the service entrance wires and the busbars above the switchboard. This presents a finished metal surface both front and back.

The A G Electric Company, of Seattle, constructed the six-panel switchboard, as well as 72 safety panels and 42 back-connected power panels, all according to the designs and specifications of The White City Electric Company.

Special lighting fixtures were installed and there are 4,500 General Electric lock sockets which are hung upon reinforced drop cords. Sherarduct was used for the conduit work and 2,500 deep Adaptiboxes were mounted in the concrete. These boxes were nailed to the form after the knockouts and back were removed. No offsets in the conduit were necessary nor was it necessary to run the pipe under the reinforcing rods. All parts of the work by this method are open to inspection up to the time the cover is put in place. The back is firmly locked in place by tightening two screws.

Provision has been made for future decorative lighting by installing three 00 risers to the roof and installing

boxes and switches. At the present time an ordinance of the city of Seattle prohibits the use of a roof sign.

An unusual feature of this installation from the contractor's standpoint was the inclusion of an automatic telephone system. The telephones, 85 in number, were supplied by the Automatic Electric Company, of Chicago, and provision has been made for an ultimate capacity of 200.

Seven Otis electric elevators were installed for passenger and freight service. Other motors are used for driving sewing machines, shoe machines, jewelry machines, conveyors, blowers, etc. The present connected load is about 500 horsepower.

A complete bell and buzzer system was installed and burglar alarms were fitted to all outside doors. There are 48 ten-inch Faraday signal bells operated from the dismissal box at the main entrance. Signal bells are also provided for calling department heads, superintendents, etc.

Installation Rules for Gas-Filled Incandescent Lamps.

Owing to the increased use of gas-filled incandescent lamps, the Department of Electricity, San Francisco, Cal., has adopted revised regulations for installation, superseding the restrictions embodied in Section 1, Ordinance No. 2582, as well as all other rules previously issued pertaining to this type of lamp.

The new rules, following the recommendations of the National Fire Protection Association, provide for the installation of gas-filled lamps for interior service in indirect and other ceiling fixtures, and are as follows:

(A) To be so grouped that not more than 660 watts, nor more than 16 sockets or receptacles, are to be dependent on one cutout, except that in cases where wiring equal in size to No. 14 B. & S. gauge is carried directly into keyless sockets or receptacles, the location of which is such as to render unlikely the attachment of flexible cord thereto, the circuits may be so arranged that not more than 1,320 watts, or 32 sockets or receptacles, will be dependent on the final cutout. Where a single socket or receptacle is used on a circuit, the limitation of watts permissible on the final cutout shall be the maximum capacity for which such socket or receptacle is approved.

(B) Must not be used in show windows or in other locations where inflammable material is liable to come in contact with lamp equipment, except where used in connection with approved fixtures where temperature of any exposed portion of same does not exceed 200 degrees Fahrenheit (93 degrees centigrade).

(C) Must not be used in connection with medium-base sockets or receptacles if of above 200 watts nominal capacity, nor with mogul-base sockets or receptacles if of above 1,500 watts capacity. Must not, if provided with a shade, reflector, fixture or other inclosure above the socket, be used in fiber-lined or similar sockets or receptacles of either medium or mogul-base types if of above 100 watts.

(D) Fixtures within buildings must be wired with conductors of approved slow-burning or asbestos covering where the temperature to which wire is subjected at any point exceeds 120 degrees Fahrenheit (49 degrees centigrade). Where fixtures are placed outside of buildings approved rubber-insulated wire is required.

Repairing a Motor.

A small motor trouble that came to my notice recently is one that is liable to be encountered at any time with small clutch motors and is apt to be difficult of solution unless the trouble has been met before.

The motor in question was a small motor with a friction clutch that grasped an outer race and thereby mechanically fastened the rotor to the shaft by friction when the machine was up to speed. The motor started up all right, but when the load was thrown on the motor gave a shrill whistle like a siren and the pulley then stood still. On disassembling the machine it was found that through wear the clutch pieces had worn down just enough so that the rotor would let go of the shaft when any where near the full loading was attempted. The motor was repaired by sweating in hard brass strips in the outer race and turning the inside rough to give sufficient grasp when the worn clutch was thrown in.

H. E. Weightman.

Reppell Electric Company Sells Out.

The stock and fixtures of the Reppell Electric Company, Thirty-first and Summitt Streets, Kansas City, Mo., were sold at bankrupt sale to John J. Magee, manager of the Federal Sign System, at Kansas City. Mr. Magee was with the Federal Company several years, in Kansas City and elsewhere. He is now operating the Reppell Company without changing its name; it has done general contracting, and had a fair business in residence work.

Oklahoma City Record in Electrical Construction.

The largest permit for electrical construction ever applied for in Oklahoma City has just been granted by the city building inspector to the officials in charge of construction work on the new $350,000 Ford assembling plant.

Among Contractors.

Charles J. Sutter & Company, electrical contractors and engineers, are installing the electric light and power system, telephones, clocks, alarm systems and automatic calls in the Oklahoma State Capitol building now in process of construction.

The Nunn Electric Company, of Amarillo, Tex., has completed arrangements for immediate establishment of a jobbing house in Oklahoma City, occupying three floors and basement of the building at 215 West First Street, on which a lease for five years was secured. A full stock of meters, transformers, motors and general electrical stock will be carried.

R. W. Keck & Company, of Allentown, Pa., one of the best known electrical contracting firms in eastern Pennsylvania, has recently moved into commodious and very attractive quarters in the heart of the business district, the change being made largely on account of the rapid expansion of the business and partly for the improved facilities offered to the retail trade in the new location. A well appointed display room stocked with a full line of appliances, greets the eye of the customer on entering the establishment. Within easy access of the display room is the supply division in the rear, while in the basement are located the shops, where all repair and heavy construction work is executed. This firm has been signally successful in the handling of large contracts involving the application of motors to various manufacturing processes. Among the contracts now being fulfilled are the supply and installation of a motor-generator set for the State Insane Hospital at Rittersville, Pa., and an ultimate installation of 280 horsepower in Wagner motors for the Gallia Silk Company, at South Bethlehem, Pa.

A new electrical concern has opened a store in the Cannon block, 192 High Street, Clinton, Mass. The members of the firm are Samuel Mahan and Emil Schmidt, two young men who have recently taken the examination given electricians, and formed a partnership. Both have had considerable experience. The store is the most up-to-date and best equipped in Clinton. The back part of the store has been partitioned off. Here fixtures are suspended and connected with different switches.

The firm plans to do all kinds of work incidental to gas and electricity. Mr. Mahan has for some time been working with Ernest P. Howe, while Mr. Schmidt was formerly employed by the Clinton Gas Light Company.

Public Service Commissions

Conducted by William J. Norton

IDAHO.

The Sandpoint Water Company Case.—The petition of the city of Sandpoint was before the Commission for some time, the decision being withheld until certain points involved in other cases before the Supreme Court of the State could be finally determined. The decision of the Commission contains important holdings on questions involved in valuations and rate-making cases.

Accrued Depreciation Not to be Deducted.—The question of whether or not accrued depreciation should be deducted is discussed at length, and the Commission, following the rules of the Supreme Court of the State as laid down in the Pocatello Water Company case (ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, July 17, 1915, p. 112), finds that no deduction should be made in this case, "as the testimony shows conclusively that defendant's plant is in first-class operating condition without any actual or tangible signs of depreciation."

The opinion by Commissioner Ramstedt further discusses the matter, as follows: "The adoption of the cost-of-reproduction-new as a basis of value in this case we believe to be just and equitable. It must be remembered that the defendant made the investment in this enterprise for as long time as the business would be in existence, and had been conducting such business up to the enactment of the Public Utilities Act in 1913, without state regulation, and in the absence of rules under which annual allowances for depreciation would be charged as operating expenses. We do not say that in case of replacements not being made when reasonably necessary, or in case of obsolescence, or in case of a utility operating and having operated under State regulation, the rule of cost-of-reproduction-less-depreciation is not the correct general rule to be applied. However, neither the Pocatello case nor this case comes within the class of utilities operating in the past under such regulation.

"Included in the defendant's capital investment are certain items of physical property which are subject to decay or will wear out and be replaced from time to time during the conduct of the business. In order to compensate the investor for loss in the public service, of property through wear and decay, and to enable him to make necessary replacements from time to time, an allowance is made him for depreciation, which allowance should be treated as an operating expense. As the different parts of the plant wear out they must be replaced, and the original investment is thus kept intact. What concerns the public is the value of the service. It is impossible to keep the plant 'brand new.' To do so would be the rankest kind of waste. If a portion of the plant is partly worn out but in condition to render the same efficient service as when the plant was new, the public has lost nothing. The loss belongs to the investor, unless he has been allowed a sufficient amount to offset the depreciation. To depreciate the capital investment and consequently reduce the earning power of the investment by reason of the fact that replacements, which are not at the time in question necessary, have not been made, would in effect be confiscation. Suppose the investor has issued bonds on the property in order to make the investment. How can he pay the interest on the bonds if the earning power of the property is decreased? He could do so only by reducing the indebtedness to the extent of depreciation, which would vary from time to time. The absurdity of such a proposition from a practical standpoint would be apparent. If the rule of depreciating the investment by the amount of depreciation should become the established policy in this State, we can see very little inducement for the investment of capital in Idaho."

Allowance for Future Depreciation.—The Commission finds that an annual allowance of three per cent of the value new of the depreciable physical properties should be made for future depreciation.

"While no deduction will be made for accrued depreciation we realize that certain physical properties begin to deteriorate from the moment they are put into service, and unless replacements are made from time to time, such properties will gradually become unfit for service. Notwithstanding the fact that defendant's plant is in first-class operating condition, without any actual or tangible signs of wear or decay, we know that depreciation has constantly been going on since the very beginning of its life, and it is only a question of time when certain items of physical properties will have to be renewed. For the purpose of showing the true condition of the plant as well as to protect the life of the plant there should be established a Depreciation Reserve account to which the cost of renewals shall be charged in accordance with the Uniform System of Accounts prescribed by this Commission."

Services Paid for by Consumers.—The engineer for the complainant made no allowance for the item of "consumers' connections" on the ground that it had formerly been the practice of the defendant to charge to the consumer this cost of making service connections.

"The records show that prior to 1908 the cost of such connections was assessed against the property owners, and that subsequent to that time, following a decision of the State Supreme Court, the cost of such service connections has been borne by the defendant. * * * There is nothing in the record to show that persons who paid the cost of service connections are now patrons of the defendant or that the premises with which such service connections were made are now held by the property owners against whom the cost of such connections was assessed. The adjustment of any claims on account of charges made for service connections in the past is, in the opinion of the Commission, a question for determination by the courts rather than by this Commission. All mains and service pipes of the system laid in the streets and alleys of Sandpoint should be owned by, and placed in positions at the expense of, the defendant."

Overhead Charges.—While it appeared that all the interest during construction which was actually paid was received from operating revenue, and while there was no evidence tending to show that the defendant ever paid out any amount as brokerage fees, the Commission found that an allowance of 15 per cent of the value of the physical properties would be just and reasonable.

Going Value.—The Commission stated that, in arriving at the value of defendant's water system, it took into consideration the earnings of the defendant in the past, the cost of reproducing the present earnings, as well as developing the business and the cost of furnishing free service to the complainant and "while the Commission makes no definite findings as to the going value, it has considered defendant's plant as a going concern, in actual successful operation."

Property Paid for Out of Excess Earnings.—The decision says: "The records indicate that a considerable portion of defendant's system has been paid for out

of what might now appear to be excessive earnings, due, as claimed by complainant, to excessive rates in the past. The Commission, however, will make no deduction to offset any real or fancied excessive earnings in the past in view of the fact that the defendant was then operating in the absence of State regulation and protection now afforded it under the Public Utilities Act, as well as in view of the unknown future prosperity and development of the territory served, at the time the defendant embarked in the enterprise now under investigation."

Rate of Return.—The Commission allows a return of eight per cent, but says: "This Commission will not be placed in a position of stifling ambition and effort in the development of public utility enterprises by adopting a fixed per centum as the rate of return which a utility shall be allowed on its investment. The rate of return will be determined in each individual case, giving due consideration to efficiency and economy in management, and thus afford a stimulus for the utility to increase its business, to reduce its operating expense and thereby reduce the cost of commodity to the consumer. If a public utility can by efficient management reduce the operating expenses below the ordinary amount, or if it can by the application of a broad and public spirited policy develop a community and thereby develop its business and increase its earnings, it is certainly entitled to share in the increased earnings directly resulting therefrom. We believe that the application of this policy will create an incentive to greater and more efficient effort on the part of the investor and that it will redound to the benefit of the community served as well as of the entire State."

ILLINOIS.

St. Clair County Gas and Electric tablished rates for gas in the city of Belleville vs. St. Clair County Gas and Electric Company, in which the Commission made a valuation of the property and established rates for gas in the city of Belleville, the following table of overhead expenses in percentage as used by the Commission staff is given.

Items included in overhead expenses	Land	Transmission and distribution	Buildings and structures	Plant equipment	General equipment
Omission in calculations and inventory	..	1	1	1	1
Engineering and architecture	2	4	5	4	..
General supervision and wear on tools	..	4	4	4	2
Interest during construction	6	4	3	3	2
Insurance, fire and liability	..	0.5	1	1	0.5
Organization	..	1	1	1	..
Legal and taxes	2	0.5	0.5	0.5	0.5
Contingencies	..	1	0.5	0.5	..
Totals	10	16	16	15	6

The decision says: "The percentages found by the engineering staff, when weighted, produce a composite overhead charge equal to 15.39 per cent of the staff's valuation of the tangible property. In addition to the 15.39 per cent, the engineering staff testified that not less than 10 per cent had been allowed in its valuation to cover contractor's profit on all items of construction which were entitled to such surcharge."

The Commission allows 7.25 per cent as a rate of return on the value of the gas property, plus an allowance of 3 per cent per annum to cover "depreciation, obsolescence, inadequacy, etc."

Submarine Batteries Discussed at Court Martial.

Trial by court martial of Rear-Admiral William N. Little, U. S. N., retired, on charges of neglect of duty in recommending the acceptance of battery tests on the submarine K-2 while under construction at the Fore River (Quincy, Mass.) shipyard, was conducted at the Charlestown Navy Yard during the week of November 1-6, by a board composed of seven rear admirals. The accused was inspector of machinery at the time the vessel was being built.

Testimony showed that while evidences of imperfect workmanship had been found and corrected in about 15 cells of the boat's storage batteries, the batteries as a whole performed on their trials all the work required of them by the contract. The prosecution contended that the inspector should have required a general overhauling of the batteries, and that he exceeded his authority in securing an agreement of the company to stand behind the equipment.

The specific defect in the battery was the finding of lead drops in a number of the cells. Chief Electrician Henry G. Grube, of the K-2, said he had never found lead drops in batteries until he saw them in the cells of the K-2. He considered their presence the result of imperfect workmanship.

R. A. Fessenden, for 30 years a student and experimenter on storage batteries and for three years head chemist for Thomas A. Edison, appeared in behalf of Admiral Little, and testified that unless lead drops caused short-circuiting sufficient to indicate at once on a voltmeter, no impairment of the battery's life nor other injurious effect would result. In cases where a battery is kept floating across busbars there might, however, be some effect on life, but none in the present instance.

Asked as to the cause of active material forming on the separators and producing shorts, Professor Fesseden answered that every time a battery is charged the volume of chemicals is different. A shelf on a plate might prevent the active material dropping to the bottom unless bubbling counteracts it. The renewal of a certain per cent of pasted plates is inevitable after about two years' service, owing to active material being deposited on warped or deformed plates. The presence of lead drops is not necessarily harmful. At the time the K-2's battery plates were burned in, even the best workmanship could not have prevented drops. Now, however, special apparatus is employed, which obviates this occurrence.

Stephen A. Gardner, Quincy manager of the Electric Boat Company, Groton, Conn., said it was customary to charge batteries soon after a submarine is launched; and until turned over to the government the battery is in constant use. In the K-2 case, 15 to 20 cells appeared abnormal before delivery. These were corrected and a three-hour discharge test was run, as required by contract, which showed the boat capable of a 8.5-miles-per-hour speed, submerged.

Joseph Starkenstein, representing the battery company, explained an appliance designed to prevent lead dropping. He stated that he personally directed the burning in of the submarine's battery. After each group was burned a magnet test was made to determine whether there was any electrical connection between plates of opposite polarity. If any appeared the elements were removed and the cause of the connection eliminated.

Admiral Bowles, president of the Fore River Shipbuilding Company at the time of the K-2 construction, testifield that Admiral Little was a very exacting inspector.

Long-Distance Telephones Along the Lincoln Highway.

The Lincoln Highway tourist across Nevada is to have another convenience at his service. It is planned to run a double-copper telephone wire along the Lincoln Highway from Salt Lake City to Ely, and thence to Reno. Cut-in stations will be established one mile apart along the way, and by means of these stations no traveler could ever become stranded at a greater distance than a half-mile from a telephone station from which he could call for relief.

A traveler will be able to procure an instrument at either end of this route by paying a small deposit on it, just sufficient to insure its return in proper condition when he reaches the station at the other end of his journey. Certainly the so-called terrors of desert travel are rapidly being shorn of their terrors.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 314.—Talking Signs.—What means are used in electric "talking" or word-spelling signs to prevent injurious arcing at the contacts where the current is continually changed from lamp to lamp?—A. F. B., New York, N. Y.

No. 315.—Motor-Driven Motion-Picture Machines.—About what percentage of our large cities having over 100,000 population permit the use of motor-driven motion-picture machines?—S. P. L., Topeka, Kans.

No. 316. — Protecting Lightning Grounds.—What is the best method of protecting lightning rods and the ground wires of lightning arresters where the wires are exposed to injury near the ground? I understand that iron pipes are objected to by some authorities.—L. F. B., Wilmette, Ill.

No. 317.—Wiring for Electric Ranges.—In wiring an apartment building for electric ranges, each of which has a maximum possible load of two kilowatts, what is the best arrangement of the special range circuits so as to economize wire and reduce the voltage drop to the minimum? Meters to be in the basement.—D. A. T, Chicago, Ill.

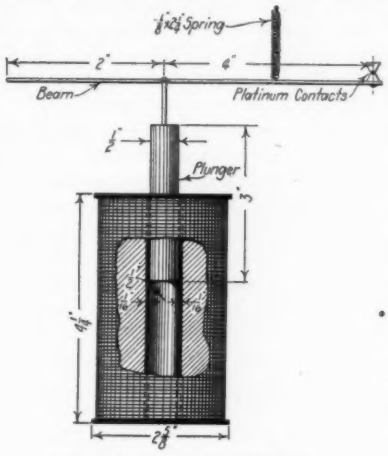
Answers.

No. 309.—Automatic Cutout.—It is desired to keep an electric water heater taking 550 watts in circuit as continuously as possible. A few other devices and lamps are also on this circuit, but are turned on for short intervals only. Is it possible to devise some automatic means for temporarily cutting out the heater while the other load exceeds one ampere? The device must reconnect the heater as soon as the other load is cut off or reduced to less than one ampere.—V. B., Milwaukee, Wis.

The ordinary current-limit relay is unsuitable for the conditions imposed. It is built to open the circuit or close it, as the case may be, at a predetermined maximum current, which it will do, but it will not reset at the same value as it kicked out at, but at a much lower value. Therefore to fully meet your conditions it is necessary to use a floating-plunger relay with spring suspension, as shown.

This type of relay will automatically reconnect the circuit when the load comes back to normal. But if a heavy current is to be handled, a contactor should be used, and the relay employed to close the contactor-coil circuit; otherwise arcing at the contacts would soon destroy them.

Should you desire to build your own relay, the dimensions given on the diagram are correct. The spring should be made adjustable, and the plunger should be about two-thirds way down in the coil. The spring can be made of 36 turns of No. 20 B. & S. brass spring wire. The



No. 309.—Automatic Cutout.

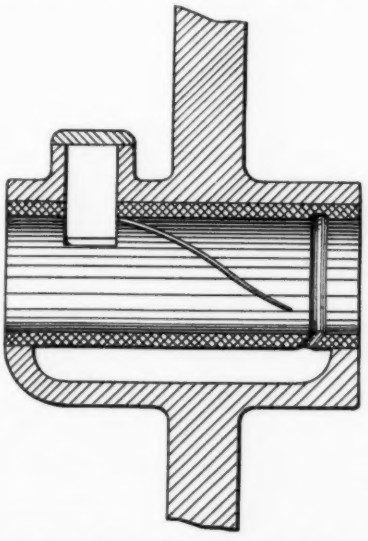
coil should be wound with 290 feet of No. 15 double-cotton-covered copper wire. —J. H. McI., North Sharon, Pa.

No. 310.—Cleaning Commutators.—I would like to know of something which may be safely used around motors and dynamos for cleaning gummy commutators, etc. We have been using gasoline, but have had trouble from sparks from the brushes igniting the gasoline.—A. S. N., Plymouth, Mass.

The cause for the commutator becoming gummy should be looked into and investigated rather than a method determined for cleaning the same after it has reached this gummy stage. This commutator is lubricated, apparently, by some oil, paraffin, or similar substance, which is not dry and which accordingly attracts and collects dust and dirt. This oil may be present in the form of a vapor, oftentimes caused by a crankshaft splashing in oil, especially noticeable on direct-connected engine-driven generator sets. More likely, however, the brushes used on the commutator are impregnated with paraffin or some other grease or oil, a method used by some manufacturers to reduce the brush friction. These brushes, when used on a commutator which has a high peripheral speed or when they are subjected to a high current density, due either to design or overload, bake and the lubricant is forced out of the brush, collecting on the commutator which causes the so-called gumming.

The remedy in either case is to purchase a set of high-grade dry brushes of fine, dense texture, which are truly self-lubricating. They consist of finely pulverized carbon with which is mixed a certain percentage of plumbago or graphite for lubrication, and in case of flush mica a small percentage of abrasive material to take care of the mica. These brushes, being of dense texture, will not absorb oil and being mixed with graphite are not only self-lubricating, but also dry. The use of brushes described above will prevent gumming of the commutator. Brushes of this quality, while manufactured abroad, can be obtained in this country. They are broadly advertised.—W. H. C., New York, N. Y.

I have perused with interest the several suggestions put forth in the issue of October 23 regarding the cleaning of commutators, which are very good, but why not get to the root of the evil? I have found 99 times out of a possible 100 that the gumming of commutators may be traced directly to the oil bearing on the commutator side, the cause being that there is oil leaking, or rather creeping, along the shaft to the commutator and thence to the brushes. Now if these brushes are soft carbon or more especially the ordinary self-lubricating brush they will gum the commutator badly; if a hard carbon this will not occur so readily, but the oil will cause sparking and cause the mica to carbonize in weak places, pro-



No. 310.—Drain to Keep Oil from Commutator.

ducing short-circuits between bars with the natural result of burning out a coil or coils, if not caught in time. Now, a remedy is this: Most bearings of later-day motors or dynamos have a groove about one-eighth inch deep cut in them, about one-fourth inch from the commutator end and, also from pulley and armature end, when they are trued up in the lathe or boring mill, with a hole bored through the bottom emptying into the oil well. See accompanying sketch, which

represents commutator-end bearing. Inspect your bearing on commutator end, clean groove of dirt, see that the hole to oil well is free or, if none is found, have a groove cut in with hole to oil well and your trouble will cease.—R. A. D., Lake Mills, Wis.

No. 311.—Simple Rate System.—Has any system of rates for residence customers of a central station ever been devised which, though based on actual or assumed maximum demand and including primary and secondary rates for, say, 30 hours' use of this demand, can be fully explained to any customer without using the words "30 hours' use," "demand," "maximum demand," or even "kilowatt-hours"? If such a simple system is as yet too ideal, what is the nearest approach thereto that has been attained?—W. H. T., Ann Arbor, Mich.

It seems to the writer that the ordinary user of electric power has no knowledge of the electrical terms or their values while he does know that he has an electric light of a certain power and can figure that when this is used a certain number of hours he will have to pay a certain amount. He can also realize that, after he has used this light for this certain time, he will get a longer time for the same money for longer use of this light.

Why not, therefore, drop the use of the electrical terms (as the writer has learned to do in the last 15 years) and tell the story in hours of light used (not "lamp-hours," as this is a technical term). One can show the customer that he will in ordinary use turn on a certain number of lamps every evening and use them for some time. This will constitute his demand, although he will not know as such. Further tell him that, if he uses these lamps for less than an average of one hour each night, he will pay for the light used at the rate of one cent times the number of hours, thus dropping discussion of the 30 hours of demand and also reference to kilowatts or kilowatt-hours. It is also better to state the case to him in candlepower of a certain lamp and connect this with the proper wattage. This is the same as telling the customer that, if he does not use his maximum demand for 30 hours per month, he will be on a certain X rate.

Further it will be plain to the customer that, if he is to use more than his average of one hour per night of a given number of lamps, he will get two rates. One as before stated and the excess will be at the rate of Y number of hours use of the given size of lamp for one cent. This Y is naturally larger than X by the ratio of the second rate over the first.—W. M. P., Seattle, Wash.

No. 312.—Connection of Bell-Ringing Transformer.—Recently I was called to correct some trouble in a door bell rung from a bell-ringing transformer. I found that the push-button was arranged to close the primary circuit of the transformer, the secondary being connected directly to the bell. The contacts of the push were burned from arcing, which did no further damage because it was in a non-combustible case. It was explained that this connection had been insisted on to save the small current that the transformer would take continuously. Is there any provision in electrical construction rules to prohibit this connection?—E. S., Atlanta, Ga.

From the Underwriters' point of view there is no objection to connecting a push-button in the primary circuit of a transformer designed for bell ringing, when the primary voltage of same does not exceed that of the ordinary lighting circuit of 110 volts, providing, however, that all parts of the circuit in question are wired in accordance with Class C, as stated in the latest edition of the National Electrical Code rules 16 to 19, pages 30 to 34. From the foregoing it will be noted that the construction must be the equivalent of that used for lighting, and would necessarily be much more costly than that commonly used for bell work when less than 10 volts are employed. There is no approved bell push-button for the voltage desired, but a standard quick-break door switch with slight modifications may be used for this.

As the iron loss in many of the small transformers designed for this class of work is practically negligible, in fact, so little that it does not register on a three-ampere integrating meter unless same is not properly adjusted to prevent "creeping," it would be better to connect the push-button in the secondary than in the primary circuit. This will insure better operating conditions and service, less tendency to arc, and cheaper and safer construction. This is the standard practice.—M. K., Passaic, N. J.

No. 313.—Trouble Near Wireless Stations.—Why is it that in residences in close proximity to wireless stations watt-hour meters frequently burn out and lamps and lamp sockets become short-circuited? Is there any danger to life or from fire? How do central-station companies overcome the difficulty?—C. F., Chicago, Ill.

When a conductor is cut by an electromagnetic field an electromotive force is induced in that conductor, the magnitude of this electromotive force depending, amongst other things, upon the length of the conductor and the strength of the field of flux. In wireless telegraphy the antennas are charged and discharged very rapidly at a high potential with the result that electrical energy is radiated into space. The amount of energy thus radiated is very considerable in the case of the large high-power stations, and even with the smaller ones belonging to amateurs may sometimes be sufficient to blow fuses, burn out the potential coils of watt meters, etc. The nearer the secondary conductors, which in this case are the house wiring and the overhead leading-in wires, are to the wireless station the greater the amount of energy induced in them, the higher the induced voltage and the greater will be the likelihood of trouble. The voltages induced in circuits in close proximity to stations may sometimes be high enough to cause sparks of 0.25 inch to jump to earth, and to occasion severe shock in many cases. While these shocks may be serious enough to cause painful blisters they usually do nothing more than bring temporary discomfort, although the muscular contractions following a shock may easily result in a person releasing his hold and falling to his death.

There are several ways in which disturbances from wireless stations may be overcome. One way is to place all wires in a metallic sheath, which in turn is grounded at frequent intervals. This method is not always feasible, for example, with overhead wires. Another way is to shunt a high resistance (noninductive) from lines to ground, so that the charge may leak away. This method is inexpensive where the amount of energy to be dissipated is small, but is unsatisfactory for other than the smallest stations. A third way, and one which is in all respects satisfactory, so far as protection is concerned, consists of installing aluminum type lightning arresters from lines to earth. Unfortunately, this type of arrester if left permanently connected to an alternating-current circuit requires rather frequent attention and renewal of the electrolyte, on account of the comparatively rapid deterioration of the latter. This is not a serious matter where skilled labor is available, as would be the case round high-power stations, but the complications and maintenance costs preclude its use in general for protecting residences. The fourth method, which is applicable to all residences, etc., consists of connecting a vacuum-tube arrester between all lines and ground. This arrester, which has been developed especially for the protection of residences, consists of a gap comprising a disk electrode operating in an exhausted tube.

Many central-station companies have rigid rules covering the connection of wireless outfits to their mains, although these rules cover the protection of the company's system and apparatus rather than the house wiring, which may be a very different thing. No one should be allowed to connect a wireless outfit to a distributing system without a permit from the central-station company, and many companies have such a ruling. Notwithstanding this, an enthusiast will now and again install an outfit, but it makes itself known by causing flickering of the lights, blowing fuses, etc.—K. R., Chicago, Ill.

Generating and Distributing Statistics of Pacific Power & Light Company.

The Pacific Power & Light Company, operating in Oregon and Southern Washington, has recently compiled an interesting schedule of kilowatt-hour statistics covering a complete record of generation and distribution on its various interlocking systems for the year ending June 30, 1915. These figures afford a comprehensive analysis of the activities of the different steam and hydroelectric stations, and respective operating territory of the company, indicating an average loss in distribution of seventeen per cent.

YAKIMA-WALLA WALLA SYSTEM.

Station	Generated Kilowatt-Hours
Drop	937,700
Naches (Steam)	1,339,925
Naches (Water)	17,557,521
Fruitvale	1,911,620
Prosser	1,399,679
Kennewick	9,900
Walla Walla (Steam)	159,096
Walla Walla (Water)	11,430,740
Waitsburg (Water)	63,573
Tucannon (10 months)	197,064
Bought from Hanford Irrigation & Power Company	988,614
Total Generated and Bought	35,995,432

City	Distributed Kilowatt-Hours
North Yakima	7,637,360
Toppenish	1,729,580
Sunnyside	784,284
Prosser	882,197
Pasco	7,934,857
Walla Walla	7,789,689
Dayton	607,186
Pomeroy (10 months)	429,207
Pendleton	1,575,214
Sold to Hanford Irrigation & Power Company	9,272
Total Distributed	29,378,346
Loss (18.4 per cent)	6,617,086

HOOD RIVER-TYGH VALLEY SYSTEM.

Station	Generated Kilowatt-Hours
Tygh Valley	3,102,800
Bought from Hood River Gas & Electric Company	231,260
Total Generated and Bought	3,334,060

City	Distributed Kilowatt-Hours
Dufur	39,530
The Dalles	2,518,430
Sold to Hood River Gas & Electric Company	105,420
Total Distributed	2,663,380
Loss (20.1 per cent)	670,680

ENTIRE PACIFIC SYSTEM.

System	Generated Kilowatt-Hours
Yakima-Walla Walla	35,995,432
Hood River-Tygh Valley	3,334,060
Astoria	5,675,375
Pomeroy (2 months)	66,808
White Salmon	110,248
Goldendale	292,000
Total Generated and Bought	45,473,923

System	Distributed Kilowatt-Hours
Yakima-Walla Walla	29,378,346
Hood River-Tygh Valley	2,663,380
Astoria	5,236,072
Pomeroy (2 months)	66,808
White Salmon	110,248
Goldendale	292,000
Total Distributed	37,746,854
Loss (17 per cent)	7,727,069

Protection of X-Ray Operators.

The Rontgen Society (London) has recently formulated a set of rules or recommendations for the protection of X-ray operators from the dangers attending the use of X-rays. These will be issued in card form.

Extraordinary Telephone Development in Chicago.

The number of Bell telephones in the city of Chicago has reached the 400,000 mark. With a population of 2,500,000 this gives Chicago approximately one telephone to every seven inhabitants. This development is confined to the city limits and does not include the Chicago Telephone Company's suburban territory. Compared to other large cities in this country this number is significant. New York City has 428,750 telephones, Philadelphia has 150,400 telephones, Boston has 88,100, Pittsburgh has 76,140, San Francisco has 118,217 telephones. These figures cover the metropolitan sections of the various cities only, and do not include any suburban points.

The city of Chicago now has more telephones than the nine countries Italy, Spain, Hungary, Belgium, Portugal, Roumania, Bulgaria, Servia and Greece combined; more telephones than the whole Russian empire and more than twice as many telephones as the whole of Austria. Chicago surpasses by far all European cities in the number of telephones in service. Lodon has 258,895; Paris has 95,033: Berlin has 154,800; Stockholm has 85,641; Vienna has 64,438; Budapest has 27,944; Petrograd has 54,815.

This attainment represents an increase of 1,400 per cent in telephones in the city of Chicago during the last 15 years. In 1900 there were only 26,661 telephones in service. This increased to 104,338 by 1905. In 1910 there were 239,082. In 1900 the average daily number of originating calls in the Chicago exchanges was 324,000. The average number of daily originating calls at present is 2,000,000. The total number of originating calls during the whole year of 1900 was 108,000,000 while the total number of originating calls last year was 607,450,000.

The Chicago Telephone Company was incorporated January 14, 1881. Its first telephone building was erected in 1887 at the corner of Washington and Franklin streets. It was a seven-story building and was considered a skyscraper at that time. The present main office building at 212 West Washington Street is 20 stories high and the largest building in the world devoted exclusively to telephone purposes. In addition to the main office building, the Telephone Company has 39 other buildings throughout the city used for exchanges and supply stations.

The underground and cable system of the Chicago Telephone Company is the largest and most complete in the world; embracing 712 miles of conduit, which contains 3,398 miles of duct, carrying 1,081,704 miles of underground wire. The aerial plant contains 119,527 miles of aerial wire and 1,475 poles.

From a pamphlet of 500 names, the Chicago Telephone directory has grown to a large book, containing more than 410,000 listings. The Chicago Telephone Company is one of the biggest employers in the city; in the city alone, the company has in its service 3,978 male employees and 6,367 female employees, of whom 5,600 are operators. The company spends on an average $6,800,000 a year for construction and wages. It is constantly extending its facilities, enlarging present exchanges and building new exchanges to meet the growing demand for telephone service.

The Chicago Telephone Company not only covers the local field thoroughly, but its affiliation with the American Telephone & Telegraph Company affords its patrons ample opportunity for telephone communication with all points in the United States and Canada. Bell lines reach 70,000 cities, towns and rural communities and extend from coast to coast.

Argentina-United States Wireless Concession.

The Federal Holdings Company, of New York, has been granted a concession for the construction of a high-power wireless station in Argentina, near Buenos Aires, for communication with a station to be erected at New York. The *Review of the River Plate* states that the company obtaining the concession owns the Poulsen patent rights in the Americas, and that it is proposed to employ this system for the new wireless service. It is also stated that the stations are likely to be in operation within 18 months.

The concession is for 30 years from the time the plans are approved. The rate between Argentina and the United States, it is required, shall be lower than two-thirds of the telegraphic tariffs in force. State radiograms and those of authorized national representatives are to be accorded preference and to be charged 50 per cent of the ordinary tariff. The company is to transmit, free of charge, the official radiograms of the government and of its agents in foreign countries, and meteorological information in less than 10-word messages between the national observatories which maintain communication with the company.

The right is reserved to impose the requirement that all of the employees shall be Argentine citizens. The operators must have Argentine diplomas identical with those required of operators on vessels flying the Argentine flag. The company undertakes to give facilities to the technical staff of the Argentine navy. It is declared that the present authorization does not imply the granting to the company of the monopoly of radio communication.

Railway Electrification at Sydney, Australia.

The American consul at Sydney, Australia, reports that at the present time two schemes for electrifying certain existing lines of urban and suburban railways are engaging the attention of the local transportation departments. The railway service known as the North Shore line, running from Milson's Point (the traffic center immediately opposite the city proper) to Hornsby (13 miles away on the main line from Sydney to the north) is about to be electrified. Already a tunnel is being driven under the harbor for carrying the necessary supply cable. The idea is to supply power for this service from the existing generating station at White Bay on the Sydney side of the harbor. The work is being carried out by the Railway Department of the New South Wales Government.

The second project is much more extensive in conception and is only awaiting the passing of an enabling bill, now in the State Parliament, before being started. The following outline of the proposed improvements has been furnished by an official of the Public Works Department, J. J. C. Bradfield, who is chief engineer of metropolitan railway construction and is in full charge of the preliminary arrangements. Mr. Bradfield recently visited the United States, and it is interesting to know that his experiences there undoubtedly paved the way for considerable American business in connection with the forthcoming enterprise. Mr. Bradfield says:

The electric railways about to be undertaken in the metropolitan area of Sydney include: (a) The immediate electrification of the inner-zone suburban railways, comprising 64 route miles or 200 track miles, and in the near future the electrification of the outer-zone suburban railways radiating some 36 miles from Sydney, an additional length of 200 track miles. (b) The construction of a 16-mile, double-track loop railway around the city of Sydney. (c) The construction of double-track railways to the eastern, western, and northern suburbs, connecting with the existing railways and with the city railway—a length of 37 miles of single track.

The ruling grades will be about 3.5 per cent with the load and 2.5 per cent against the load, while the sharpest curve it 11.5 degrees radius. All platforms will be 520 feet long, and will be placed in shallow subways; access will be generally by steps. Power will be supplied from overhead wires to the train motors at 1,500 volts.

The railways to the northern and western suburbs necessitate long-span cantilever bridges across the harbor, without piers in the fairway; the bridge to North Sydney to be 1,600 feet center span, accommodating four lines of railway, a main roadway 35 feet wide, a motor roadway 18 feet wide, and a footway 15 feet wide. The bridge to Balmain to be 1,350 feet center span, accommodating two lines of railway and the same roadways and footways. The clear headway for shipping under the bridges to be 170 feet at high water.

The total cost of the scheme is approximately £20,000,000 ($97,330,000 at normal rates of exchange). An act authorizing the expenditure of £6,400,000 ($31,145,600) is before Parliament.

The construction of the city railway and portions of the eastern and western suburban railways are to be put in hand and carried out by the firm of Norton Griffiths on a percentage basis, the Public Works Department supplying plant and material.

Institution of Electrical Engineers.

No students' meetings of this institution will be held in England during the season which has just opened. Men of "eligible" age from these sections are either away on military or naval service, or are engaged in connection with war munitions engineering operations. For the same reasons the general engineering societies are making no arrangements for students, and all the great universities and schools have their ranks greatly depleted. The presidential address to the Institution of Electrical Engineers in London was to be delivered by C. P. Sparks, the new president, on Thursday, November 11. The meetings at some of the sections in the provinces will be fewer in number than usual as these are held in districts where war manufacturing is at its height. The following are the matters that are coming before one or another of the meetings in London or the provinces during the next few months:

"Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

"Design of High-Pressure Distributing Systems," by J. R. Beard.

"Predetermination of the Performance of Dynamo-Electric Machines," by Prof. Miles Walker.

"Possibilities in the Design of Direct-Current Traction Motors, etc.," by N. W. Storer.

"Electric Heating: Its Present Position and Future Development," by G. Wilkinson.

"Distribution and Rise of Temperature in Field Coils," by Prof. Magnus Maclean and D. J. M'Kellar.

"Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks," by J. D. Morgan.

Louisville Jovians Complete Plans for Electrical Prosperity Week.

The night of November 29 has been selected by the Louisville Jovian Committee for the parade which will inaugurate Electrical Prosperity Week in Louisville. The remainder of the week's activities will be centered at the festival to be held in the Armory at Sixth and Walnut Streets. Plans for the celebration in Louisville are going ahead and the members of the committee are looking forward to a celebration which will do much for business.

Big Gun Shuts Off Current in Hoosac Tunnel.

During the passage of a 16-inch gun through the recently electrified Hoosac tunnel, on its way from the arsenal at Watertown, Mass., to the Sandy Hook, N. J., proving ground, the electrical energy was entirely shut off in the tunnel as a precaution against short-circuiting with the overhead wires. The two special cars carrying the gun were hauled by steam.

The cannon is the largest army weapon yet produced in this country, its weight being 113 tons.

Dinner Meeting of Chicago Electrical Engineers.

An innovation in the series of joint meetings of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, will be the dinner meeting to be held at the Hotel Sherman, Chicago, on the evening of November 22. Leonard A. Busby, president of the Chicago Surface Lines, will be the principal speaker, his subject being "Street Railways."

New Officers of Philadelphia Vehicle Section.

At a meeting of the Philadelphia Section of the Electric Vehicle Association of America held on October 26 the following officers were elected:

Chairman, R. Louis Lloyd.

Vice-chairman, Emlen S. Hare.

Secretary, H. H. Doering.

Executive Committee: Walter H. Johnson, F. B. Whitney, A. W. Young, R. L. Heberling, W. A. Manwaring.

Dayton Jovians Will Celebrate.

Jovians of Dayton, O., are planning to hold one of the most spectacular rejuvenations ever seen in that city on December 2, at the Hotel Miami. The rejuvenation proper will be held in the roof garden, and a number of candidates will be initiated. The banquet following is to be the most elaborate ever held by the organization, in honor of a number of distinguished guests.

Causes of Electrical Accidents in English Collieries.

One of the British government's inspectors of mines has reported on the circumstances attending four fatal electrical accidents which occurred in the York and North Midland Division. In one case a tipper, while working at the screens, was killed by an electirc shock sustained by touching a bare place in a lighting cable which was by mischance at 500 volts above earth potential. While standing under the lintel of an opening through which the tubs were delivered and through which there passed three ordinary lighting wires, No. 14 gauge, rubber-insulated, tape-wound and braided, he cried out and was found to have hold of one of the wires which was bare for about 0.75 inch. The lamps on the circuit were 110-volt, but the circuit was supplied by current from a 500-volt three-phase system, one wire of the circuit being connected to one of the phases of that system and the other to a tapping taken from the transformer supplying the 500-volt current (which originated from a 11,000-500-volt transformer). The pressure between the line to which the lamps were connected and the tapping point in the transformer winding was 110 volts. In this way, the normal 110-volt circuit was in reality a 500-volt circuit, as an earth on either of two phases would cause the lamp circuit to assume a pressure of 500 volts above earth. Subsequently it was found that one of the phases of the system, other than that supplying the lamps, was faulty, there being an earth in a small meter-transformer in the substation. The man in all probability received a 500-volt shock. Mr. Nelson, the government electrical inspector, recommended that it be made the duty of some particular individual to see to this lamp circuit and maintain it; that only low pressure should be used for lighting; and that some means be provided for indicating any defect in the insulation of the 500-volt surface system, and of every system.

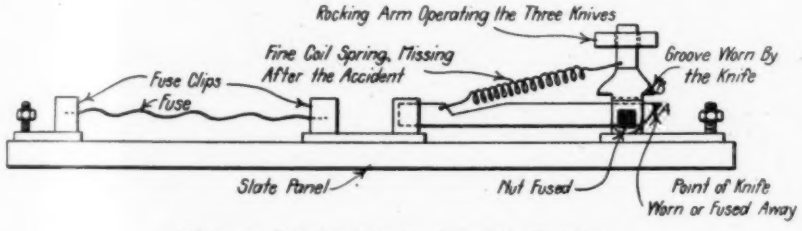

Rocking Arm Operating the Three Knives
Fine Coil Spring, Missing After the Accident
Groove Worn By the Knife
Fuse Clips
Fuse
Slate Panel
Nut Fused
Point of Knife Worn or Fused Away

Diagram Showing Cause of Switch Trouble.

In the second case an oiler was electrocuted at the by-product coke-oven stamp. The motor and gearing driving the stamp were mounted on a traveling platform moving on rails about ten feet from the floor level. The main switch was mounted on the wall of the building and below the traveling platform, and at a height convenient for the operator there was a controller. Three-phase current at 500 volts was supplied through the switch to overhead bare wires, and from these wires rubbing contacts supplied the motor. It was the man's duty to oil the machinery on the platform, but before doing so to switch off the current. He had apparently operated the switch handle for this purpose, as it was subsequently found in the off position, but afterwards by placing his right hand on the bare wire he got electrocuted. When the switch cover was removed it was found that the release mechanism of one knife was broken, thus leaving one phase alive. As shown in the accompanying sketch, the release was controlled by a fine coil spring between the rocking lever and one end of the knife. The other end of the knife at the point *A*, where struck by the rocking arm, was worn away and there was a slight groove worn in the saddle at *B*, so that when the switch handle was moved to the off position it would fail, without the spring, to open the switch. The wearing of these points would put excessive strain on the spring. There was considerable evidence of fusing in the box and all three springs were gone. The British Regulations require that "every switch intended to be used for breaking a circuit, and every circuit-breaker, shall be so constructed that it cannot, with proper care, be left in partial contact. This applies to each pole of the double-pole or multi-pole switches or circuit-breakers." It was said that the switch in this case had worked satisfactorily for four years and was testified by an electrician to be in working order seven hours before the accident; also that the ram driver had hold of the bare wires two hours before the accident. But Mr. Nelson, after examining the switch, held that it had not been properly maintained, and that its failure so soon after inspection indicated neither efficient inspection nor satisfactory maintenance. The switch required renewal and those responsible had failed to attend to it.

In the third case a coal-cutter machine man working a 25-horsepower bar cutter (440-volt, squirrel-cage, three-phase motor) received a fatal electric shock at the coal face while fitting a rail to a steel tie just in front of the machine. He was found dead with the loose rail in his left hand and a hammer in his right. When the trailing cable was opened out it was found to have two faulty places on the conductors and two breaks in the earth wire. An assistant electrician said he had examined the trailing cable about ten hours before by passing his hand along the leather covering, but the inspector says that by such an examination he could not judge more than that the covering was right. Owing to the way in which the cable was constructed it was impossible to say definitely where the cable was faulty until the leather cover had been stripped off. Only a test would indicate the break in the earth wire. The cable had been in use five years and was naturally in a well worn condition. The break was no doubt due to constant coiling and uncoiling under working conditions. A month is regarded as too long to trust to the continuity of any earth conductor; indeed Mr. Nelson holds that earth conductors of trailing cables should be tested for continuity each day.

The last of this series of accidents was the death of an assistant electrician while he was engaged in splicing an electric cable carrying 550 volts pressure in a gateway in a colliery seam. The man had himself, before proceeding to work, chalked on the junction switch-box cover the warning: "Don't touch this switch!" The current was subsequently switched on by some person unknown. This accident was, of course, quite avoidable and was apparently due to somebody's carelessness in failing to read the notice. It has since been arranged for the switch lever to be locked while repairs are going on between the switch and the coal face. In such cases the key should be in the possession of the individual working on the dead conductors. The inspector (Mr. Mottram) adds: "This appears to be the practice in working on high and medium-pressure mains on the surface, and it is obviously as necessary underground. Clearly no person's life should depend upon a chalked message being observed and acted upon."

Mr. Mottram shows in the course of much statistical and other matter, that the number of portable electric safety lamps in use in the collieries in his district has grown to 38,035 as compared to 25,004 and 4,608 in the two preceding years.

Edison and Tesla Named for Nobel Award.

Thomas A. Edison and Nikola Tesla have been mentioned, Copenhagen dispatches state, as likely recipients of the Nobel award for physics.

Novel Features to Characterize Electrical Prosperity Week in Many Cities.

It is now apparent from many indications that the Electrical Prosperity Week celebration which is to begin on November 29 will be no ordinary affair.

Collier's, the well known national weekly magazine will issue a special advance edition to its regular November 27 Electrical Prosperity Week number devoted principally to giving publicity to the celebration and what it hopes to accomplish. This edition by November 15 will go to 25,000 central stations, dealers, contractors and jobbers in addition to the thousands of other readers. It is a significant fact that this is the first time that any of the more widely circulated popular magazines ever gave so much prominence to a trade movement. The edition will contain an editorial; a letter from Thomas A. Edison endorsing the movement; news of what the cities are doing everywhere to participate in the celebration; and many special advertisements from manufacturers.

Many newspapers will also bring out special editions for the Week, among these being the following: *Los Angeles Times, Omaha Daily News, Wisconsin State Journal, Milwaukee Sentinel, Houston Chronicle, Pittsfield (Mass.) Journal, Brooklyn Eagle, Richmond Times-Dispatch, Morning Republican,* Findlay, O.

Electrical shows thus far definitely announced will be held in the following cities: Atlanta, Ga., Cincinnati, O., Dayton, O., Duluth, Minn., Chattanooga, Tenn., Denver, Colo., Springfield, O., Tampa, Fla., Sioux City, Ia., Trinidad, Colo., Fort Wayne, Ind., Tulsa, Okla., Erie, Pa., Louisville, Ky., Milwaukee, Wis., Memphis, Tenn., Richmond, Va., Norfolk, Va., New Castle, Pa., Peoria, Ill., Pittsfield, Mass., Sandusky, O.

A novel feature arranged for the celebration at Trinidad Colo., will be a 20,000-candlepower searchlight mounted where it can play on the business district during the celebration. Other searchlights will be mounted on the nearby mountain tops. An automobile parade has been planned which promises to be the principal event of the Week.

In Birmingham, Ala., it is planned to have the churches, schools, stores and factories burst forth in a blaze of lights each night of the Week. There will also be special demonstrations and an electrical parade.

An especially interesting feature of the celebration at Cincinnati, O., will be an electric fountain, 28 feet high on the Fountain esplanade. The falling water will be represented by sparkling electric lights.

In Findlay, Ohio, Main Street is to be a blaze of light. Great festoons of red and green bulbs are to swing across the street every hundred feet from the C. H. & D. Railroad on the north to Hardin Street on the south. Electrically lighted pageants, the like of which have never been seen in Findlay are to feature the evenings. A Mardi Gras carnival is planned for one night. A great electric sign proclaiming Findlay's prosperity is to be erected above the Main Street bridge. It will extend entirely across it.

The electrical exposition to be held at Denver, Colo., is arousing widespread interest on account of the prominence which it will give to electrical mining machinery and the use of hydroelectric power.

A miniature mine will show the electric hoists, rotary diamond drills, coal cutters and all the machinery used in an up-to-date coal mine. Already students from the School of Mines and other universities of the state are planning to attend the exposition in bodies, to study the various phases of electrical development, and the professors are showing a vast amount of real interest, encouraging the students in every way to save the Week for the exclusive study of electricity in its myriad forms demonstrated at the exposition.

There will be working demonstrations also of water power in its millions of forms, showing the force which for years went to waste in Colorado, now being used as the mightiest power and the most economical means of moving the vast machinery of the state.

According to the plans as thus far developed, it seems certain that features will be offered in many cities which have not before been seen. The public cannot fail to see electricity in a new light and to be brought more closely to its many possibilities.

Milwaukee to Have Electrical Show During Electrical Prosperity Week.

One of the main features of Electrical Prosperity Week in Milwaukee, Wis., will be an electrical show. For this purpose the Milwaukee Electric Show Association has been incorporated by men representative of the various electrical industries of Milwaukee. The incorporators are: H. P. Andrae, of Julius Andrae & Sons Company; Philip Polachek, of Charles Polachek & Brother; Charles L. Benjamin, of Klau, Van Pietersom, Dunlap, Incorporated; E. L. Burdick, of the Electrical Contractors' Association; H. L. Meyer, of Vaughn, Meyer & Sweet; R. M. Van Vleet, of the Cutler-Hammer Manufacturing Company; S. B. Way, of The Milwaukee Electric Railway & Light Company; H. O. Seymour, of the Wisconsin Telephone Company. The officers of the association are R. M. Van Vleet, president; Philip Grossman, vice-president; P. C. Burrill, treasurer; S. J. Gates, secretary.

The electric show will be staged on the first and second floors of the University Building. The first floor will be devoted to the heavier apparatus, such as motors, power-plant equipment, etc.; the second floor will be devoted to fixtures, household appliances, etc. The show will be open on Saturday, November 27 from 7 until 11 p. m., this to be somewhat of an exclusive night, only those having invitations being permitted to enter. The show will be formally opened to the public on Monday, November 29 and will be open each day of that week, Electrical Prosperity Week, from 10 a. m. to 11 p. m. Tuesday will be Housewives' Day; the following successive days will be Illumination Day, Wisconsin Day, Industrial Power Day, and Children's Day.

No admission will be charged, but the exhibitors will be provided with tickets for distribution. Numerous prizes will be given throughout the show. The entire show, both interior and exterior, will be brilliantly and attractively illuminated. The entire block between Wisconsin and Mason Streets will be specially lighted; arches and flood lights will brighten up the front of the exhibition building.

Special advertising is being undertaken in the newspapers and by means of a large number of bill-boards in Milwaukee and vicinity. Electrical firms will advertise the show liberally by means of various mailing schemes. A series of electric booster trips is to be made on interurban cars to adjoining towns during the ten days preceding the show. One of the cars on the booster train will be a large flat car provided with canopies to house various electrical exhibits suitable for a traveling show.

Most of the space in the Milwaukee Electrical Show has already been contracted for, although the undertaking is barely a week old. Philip Grossman, of the Electrical Engineering & Equipment Company, is chairman of the committee on arrangements.

Steel Electricaliy Produced Direct from Ore.

United States Consul Felix S. S. Johnson, of Kingston, Ont., Canada, has reported on the electric smelter at Belleville, near Kingston, which produces steel of all grades, including tool steel, direct from the ore. An unusual feature of the process is the use of a preheater that utilizes the heat from the waste gases produced during the smelting of the ore. The preheater consists of two wrought-iron pipes 8 feet long, increasing regularly in diameter from 14 to 18 inches, to allow the charge to slide easily down the heated portion. These pipes are

inclosed in the preheater stack, which has firebrick linings and baffle plates with openings arranged in such a manner that the heated gases circulate about the preheater pipes.

The furnace is charged from the upper floor into the preheater, the charge consisting of iron ore, limestone, and charcoal, crushed to pass through a one-inch mesh. The furnace is operated on two-phase current, the transformers being connected by the Scott connection. The electrodes are three inches in diameter, threaded so that they can pass down continuously, and are used up entirely, there being practically no loss from short ends.

The plant was in operation for about two months, and demonstrated that steel can be made in this manner directly from ore containing 7.5 per cent of titanium. A quantity of high-carbon steel was made, the ingots being perfectly sound and free from blowholes. The company intends to erect shortly a three-ton furnace, with a view to making high-carbon tool steel and steel castings.

Massachusetts Municipal Electric Plants.

Annual returns of the municipal electric lighting plants in Massachusetts, rendered to the Gas and Electric Light Commissioners for the year ending June 30, 1915, indicate a substantial growth in kilowatt-hour output and in the number of commercial customers. There are 36 municipal plants in the state; 18 generate their own electricity and 18 purchase energy from companies in other cities or towns.

The largest municipal plant, that of Holyoke, had an output of almost 14 million kilowatt-hours, of which about 10 million were sold to commercial and residential customers.

The returns filed with the Commission are practically identical in form to those required of private corporations. The law in Massachusetts now prescribes that the excess of the estimated annual expense (which includes gross expense of operation, maintenance and repair, depreciation, interest on debt created to pay for the plant, sinking fund or debt requirements, and loss in operation the preceding year, if any) over and above the estimated income from sales to private customers shall be included in the municipality's appropriation for maintenance and in the tax levy. For this excess, which it must raise by taxation, the city receives its street lighting, the custom being to charge regular rates for energy furnished public buildings.

In some instances, specific appropriations are made for street lighting, in which case direct appropriation for plant maintenance is relieved by so much. The Gas and Electric Light Commission, in its most recently published report, for 1914, gives the estimated cost of street lighting to the several cities and towns having municipal plants. The figures are based on the theory that for its expenditure the municipality is getting only its street lighting and the income from the commercial business, and that the cost of street lighting is the difference between the income and the cost of carrying on the business. The following is the range of prices for the various sized incandescent units, time of operation ranging from 5.1 to 10.9 hours a night, 27.2 to 30.4 days per month:

SIZE AND TYPE OF LAMP	COST PER LAMP PER YEAR
40-watt incandescent	$1.19 to $11.43
50-watt "	3.47 to 24.56
60-watt "	3.27 to 16.75
75-watt "	2.24 to 18.45
100-watt "	2.98 to 21.26
250-watt "	14.73 to 66.96
350-watt "	20.67 to 55.72
1,200-cp. arcs	15.75 to 56.83

A number of municipal plants, which simply own their pole lines and do a distributing business, purchased energy from hydroelectric sources, at about 2.5 cents a kilowatt-hour.

Connecticut Company's Transmission Voltage Changed Without Interruption to Service.

The Connecticut River Power Company, of New Hampshire, which operates a 30-mile transmission line connecting the Vernon generating station with the plant of the Fall Mountain Electric Company at Bellows Falls, Vt., recently changed over its transmitted potential from 19,800 to 44,000 volts pressure without interference to the power requirements of any of the customers supplied. The line was constructed to carry 66,000 volts, and is of wishbone construction. Formerly the transformers at the Bellows Falls generating station were fed from the local plant at 2,300 volts, from the Vernon station at 19,800 volts, and energy was usually transmitted thence north to the Colonial Power & Light Company's system at Springfield, Vt., at 44,000 volts. Now the Connecticut River Power Company's system is at the higher potential throughout the 46 miles.

Three new 1,500-kilowatt transformers were installed at the Vernon station specially for the new voltage, and three pole-type disconnecting switches were installed at the Bellows Falls station. In making the change-over, the 19,800 volt taps were removed and the connection made to the 44,000-volt taps. This occupied only a part of one Sunday and involved a shut-down of the line for but a few hours.

It is expected that construction of a new generating station of large capacity at Bellows Falls will be begun shortly.

Resistance of Radiotelegraphic Antennas.

The resistance of a radiotelegraphic antenna may be divided into three parts: first, the true resistance of the wires; second, the so-called radiation resistance; and third, the so-called earth resistances. The first is generally negligible where a sufficient number of wires in parallel is used. The second is derived from the expression for the radiated energy of an antenna, which is

$$E = 160\pi^2 h^2 / \lambda^2 I_s^2$$

where h represents the height to the center of capacity of the antenna, λ the wave-height, and I_s the current measured at the base of the antenna. The expression $160\pi^2 h^2/\lambda^2$ is called the radiation resistance, as it takes the same position in the energy equation as that occupied by R in the case of ohmic losses. The expression shows that the radiation resistance falls rapidly as the wave-length is increased.

Up to the present no satisfactory theory of ground resistance has been developed. The experimental curves of antenna resistance, on account of the decreasing radiation resistance, fall rapidly at first, as the wave-length is increased, and then, as the wave-length is further increased, remain nearly constant if the ground conditions are good, as in the case of a ship's antenna, or again rise nearly in a straight line if the ground conditions are poor. This rise may be very rapid in the case of peculiarly poor grounds. For instance, the resistance of the Bureau of Standards antenna rises from 13 ohms at 800 meters wave-length to 28 ohms at 2,000 meters. Great difficulty has been found in explaining this increase of resistance with increasing wave-length, but the following explanation is given by L. W. Austin in the *Journal of the Washington Academy of Sciences.*

The antenna system must be looked upon as a condenser, the antenna itself being the upper plate and the ground water the lower plate. Between the ground water and the surface there is usually a layer of semi-conducting material which would correspond to a poor dielectric in the case of an ordinary condenser. It is well known that the dielectric losses in imperfect condensers generally increase in proportion to the wave-length of the current employed in the measurement. It is found that by covering the surface of the ground under and around the antenna with a wire net, thus making the net the lower plate of the condenser, the ground losses nearly disappear.

Australian Navy Department to Supervise Wireless.

The Australian Government has decided to transfer the wireless telegraph work from the Post Office Department to the Navy Department.

New Electrical and Mechanical Appliances

Nonbreakable Fuse Plug.

Where the ordinary porcelain-body Edison fuse plug is exposed to rough handling in shipment or while being taken from the stock room to the point of use, considerable breakage is found to occur. To overcome this difficulty, the Connecticut Electric Manufacturing Company, Bridgeport, Conn., has recently placed on the market a plug that is practically nonbreakable. It is made of white horn fiber, which makes a body of great strength and durability. The cylindrical body has a thinner wall than the porcelain plug which gives a much larger internal air space and therefore safer and more reliable plug. The light weight and more rugged and compact construction of the plugs permits as many as 500 of them to be packed readily into a paper carton weighing only 18 pounds and 13.5 by 11.5 by 7 inches in dimensions. This means that these plugs can be shipped in standard package lots by parcel post or express to any part of the United States quickly and at comparatively low expense. These plugs are nonfillable; they have been approved by the Underwriters' Laboratories.

Fiber-Body Fuse Plug.

Electrically Operated Rubbing and Polishing Machine.

One of the important elements in the cost of any piece of furniture is the finish and polish given to it. The finer the finish, the more rubbing is required. In the older methods where this was done by hand this involved very tedious and costly work. A number of pneumatically operated rubbing and polishing machines have been developed, but these are very noisy in operation and entail considerable investment, because of the necessary air-compressor equipment.

An electrically driven machine for this purpose has recently been developed, which is believed to be a marked advance in equipment for this purpose. As shown in the illustration, it is a completely inclosed, compact and portable outfit, connected by flexible cord to any lighting outlet. It contains a one-fourth-horsepower motor, controlled by a simple snap switch. This motor is connected by suitable mechanical means so as to oscillate the two pads on the bottom of the machine. These felt pads are each 5.5 by 4.5 inches in area and are given an oscillating motion 400 times per minute toward and away from each other. These pads can be readily removed in a few seconds by the pressure of a finger. To them can be affixed emery cloth, sand paper or other grinding, smoothing or rubbing surfaces.

Electric Rubbing Tool.

This machine works very efficiently and ecomonically. It does about five or more times as much work as a man can do by hand, and at a cost of only a few cents per hour. Its work is uniform at all times, unlike that of the manual finisher, whose work becomes less and less efficient, due to fatigue, as the day advances. The machine is provided with black fiber handles, which make it convenient to move it about over the surface being treated. The machine weighs 25 pounds, which weight has been found most effective for this service. The motor is entirely closed and protected from dust or moisture. The motor itself and the mechanism it operates are very ruggedly built, and are free from parts liable to get loose. The machine is very substantial in every respect, and is covered by a two years' guarantee. The outfit is self-oiling and needs practically no attention, except the turning on and off of the current. In operation the pads move to the extreme ends of the outfit, which permits polishing into corners.

Although designed particularly for use in the finishing rooms of furniture and piano factories this "H. J. B." rubbing tool is also useful for polishing marble or wood floors, glass, tile and other surfaces. It is being sold through Bagge's Trading Agency, 1363 Monadnock Block, Chicago, Ill.

Composition Current Tap and Lamp Receptacle.

Ever since the development of heat-proof composition materials that possess the insulating qualities of porcelain, without its liability to breakage, there has been a steady increase in the use of composition sockets, receptacles, etc., in places where porcelain was formerly used exclusively.

Composition Current Tap.

To the array of such products there has now been added a new combination current tap and lamp receptacle which is made of very tough composition material capable of withstanding hard usage without damage.

This device was designed primarily for use in industrial plants, but is equally serviceable in mercantile establishments, residences and other places where a durable and highly insulated current tap is needed. The device is provided with standard contacts and is interchangeable with the exceptionally complete line of Hubbell T-slot wall and flush receptacles. It is manufactured by Harvey Hubbell, Incorporated, Bridgeport, Conn.

There are over 125 different farm operations in which electricity can be used.

New Types of Globe Electric Ranges and Stoves.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 21, 1915, there was given an illustrated description of a line of very handsomely finished and sturdily built electric ranges made by the Globe Stove & Range Company, Kokomo, Ind. The three ranges then shown were of the highest type of construction and finish, and necessarily involved high first cost. To meet the demand for moderate and low-cost equipment in this line the company has placed on the market a number of new models, two of which are illustrated herewith.

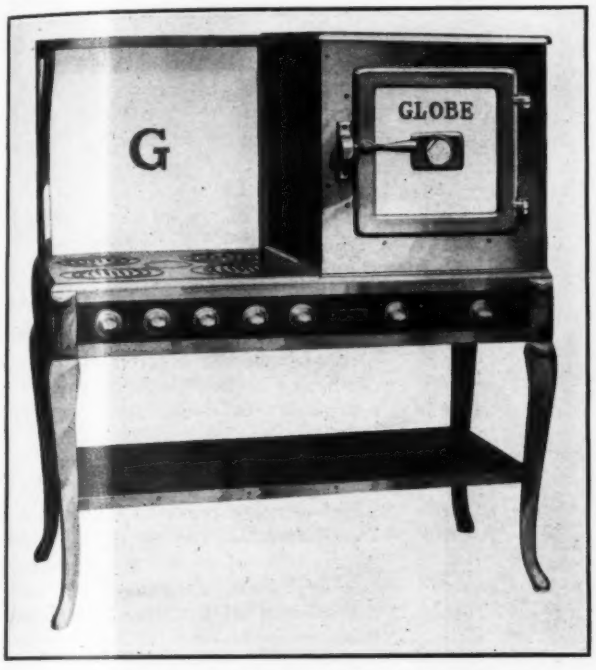
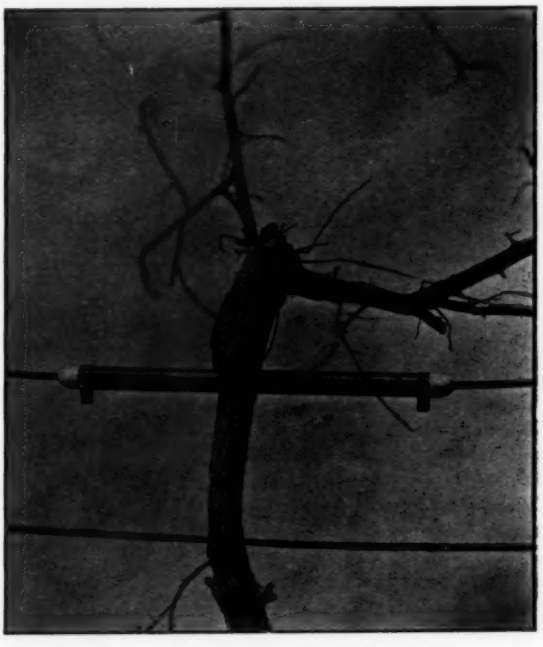


Fig. 1.—New Model Globe Electric Range.



Rogers Tree Insulator in Service.

Into the design of all these models, both of the high-priced and lower-priced types, the company has put nearly 40 years of experience in stove and range building, culminating in five years of careful investigation and experimentation of electric equipment particularly suited to the needs of the modern housewife. The result has been an assortment of electric stoves and ranges markedly different from the product of other makers.

Of the newer models, the one shown in Fig. 1 is similar in general design to one of those illustrated in the former article. A less expensive finish is employed; there is less white enamel and nickel, but even at that the range is very attractive in appearance. The main cooking surface is a hammered planished sheet. In this are five heating elements or "burners." Two of these are three-heat units and two single-heat units; a small simmering unit is placed in the middle. This range is not provided with a main switch nor pilot light, nor are castors supplied; it has been found that these features are not, as a rule, absolutely required. This range includes those features that have been found to be most popular by the average up-to-date housewife.

In Fig. 2 is show a new type of electric hot plate, with a three-heat element. This is mounted in a convenient raised stand made of Armco rust-resisting iron with nickel trimmings. This makes a very neat, durable and serviceable outfit. Like all the Globe heating elements this unit is of special construction, to combine the advantages of both the open and inclosed types, and is said to have the disadvantages of neither. It is possible to heat any ordinary cooking utensil directly on the hot plate. The coils are placed in grooves in an insulating base; a thin cast-iron top plate correspondingly grooved protects them.

Fig. 2.—Single-Unit Globe Hot Plate.

The outfit shown in Fig. 2 is one unit in a new line of electric stove parts arranged to be assembled on the sectional-unit plan. This line includes a combination baking, roasting and broiling oven, a two-unit hot plate and various types of low and high supporting stands. It is possible to start with one of these hot plates or ovens and add to the equipment from time to time, until there is produced a complete electric range for all cooking.

In line with its progressive policy of increasing its array of electric cooking appliances, so as to have an assortment that will meet every requirement, and, in fact, anticipate future requirements, the Globe Stove & Range Company is developing five new models of electric stoves at its factory in Kokomo. Three of these will be announced to the trade in the near future. When the line of Globe electrics is thus extended, it will comprise electric stoves ranging in price from $25 to $500, which will make it, according to the claim of the company, the most complete line of the kind on the market.

Rogers Tree Insulator.

Where overhead telephone and electric light lines pass through residence districts in which shade trees abound, much care is necessary to avoid damage to the trees, else the ill will of the property owners be incurred. If the line rubs directly against the tree, the insulation is quickly worn off and a ground established through the moist branches of the tree. This not only damages the tree, but constitutes a hazard to children or other persons who may come in contact with the tree, besides being the cause of wasteful leakage currents.

These difficulties are overcome by

the use of an effective tree insulator, such as the one shown on page 907. The Rogers tree insulator is a simple device that can be quickly applied to the line where needed. It consists of a strong, split metal sleeve into the ends of which when assembled there are put split porcelain bushings. A clamp at each end holds the parts firmly together. The bushings serve both to insulate and center the wire in the sleeve. The latter is well galvanized to protect it from the elements. It takes all of the rubbing of the tree branches or trunk and thoroughly protects the line from contact with the tree.

Rogers tree insulators are made for five sizes of wire from No. 8 to No. 0 and they are furnished in various lengths from one to six feet. They are manufactured by the Frank Ridlon Company, 158 Summer Street, Boston, Mass.

Naval Men Witness Test of New Method of Refrigeration.

A number of prominent naval and shipbuilding officials were present at East Pittsburgh, Pa., on October 29 to witness a test on a new refrigerating machine manufactured by the Westinghouse Machine Company. The machine was invented by Maurice Le Blanc, the originator of the well known Le Blanc condenser, which is being manufactured and marketed in the United States and Canada by the Westinghouse Machine Company.

The question of refrigeration on shipboard, particularly on battleships, has always been one of importance, and it is predicted that this machine will greatly aid in solving the problem. A particular feature of the machine is the absence of all chemicals or compressed gases, such as carbon dioxide, ammonia or sulphur dioxide, which are generally used in connection with refrigeration. The presence of tanks of such gases under pressure is always an element of danger, particularly on battleships when likely to be struck by an enemy's projectile.

Among the other advantages claimed for the machine are small space and light weight, simplicity of operation, high efficiency, and the fact that the cooling of the water or liquid is accomplished in the machine itself without the use of a cooler. The test was entirely satisfactory, and those present expressed much interest in the results obtained.

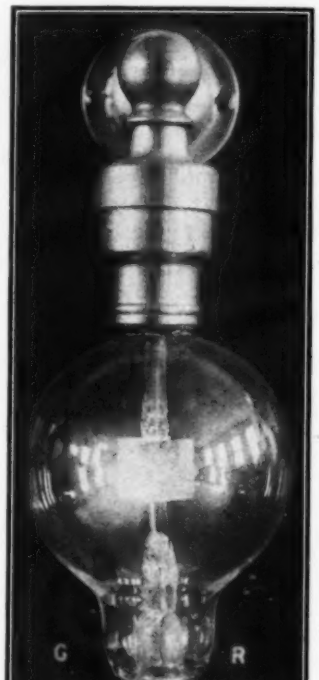
First Public Use of the de Forest Lamp as an Oscillating Audion.

For the following interesting and self-explanatory account we are indebted to Dr. Lee de Forest.

"In the recently announced long-distance radiotelephone demonstrations from Arlington to San Francisco, Honolulu and Paris, full use was made, for the first time in a public test, of the oscillating audion or incandescent-filament evacuated-vessel oscillator.

"At the Arlington transmitter a bank of 300 large bulbs seven inches in diameter, very similar in structure to and embodying the elements and circuits of the de Forest "oscillion," illustrated and described in *The Electrician* of June 12, 1914, was used. These were energized from a common direct-current dynamo of 250 volts, their output circuits acting in unison on the common radiating antenna.

"Other auxiliary audion paths which were in their turn voice-controlled from a 'master microphone' are at



From Photo by Paul Thompson.

DeForest Audion Lamp Used in Wireless Telephony from Washington to Hawaii.

times used to control this high-frequency energy as generated.

"This method is new in the larger amount of power here for the first time generated (approximately 75 kilowatts), but the cost of maintenance of the comparatively large number of really expensive bulbs and the difficulty of maintaining the requisite high vacuum make it, as yet, less practical than is the arc-in-hydrogen transmitter. The main point in its favor (the oscillion's) is the ease with which large power outputs can be controlled by a small master microphone.

"At the receiving station of the Navy Department the de Forest audion detector and amplifier were used, connected so as to first amplify the high-frequency currents to approximately 100 times their original intensity, and then to transform these into low-frequency telephone currents capable of actuating the telephone receivers.

"Thus the incandescent lamp, as audion detector, amplifier, and high-frequency generator, has very suddenly come into its own. It is gratifying to the one who for ten years has been working almost exclusively on this principle of the incandescent lamp as an accessory in radio transmission, and who until the last two years was practically alone in that field, to see this sudden and amazing justification of the faith he has always had in the possibilities of the principle which he first discovered."

Further Developments of the Audion Lamp—Music From Light.

In view of the great interest in the oscillating audion since its use in the remarkable radiotelephone demonstrations announced recently, it may be worth while to call attention to its development and to another use of it. Supplementing the article published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 20, 1915, Dr. Lee de Forest has written the following account of the use of the audion lamp for producing musical tones.

"While working on my experiments in developing the audion as a wireless telephone detector and incidentally as an amplifier to be used on long-distance telephone lines, I made the discovery years ago that when the circuits of the audion were connected in a certain way, a clear musical note was heard in the telephone receiver, which was connected in one of these circuits. The quality of the note was very beautiful, and I found after a little experimenting, I could change this quality or timbre into a great variety of sounds, imitating, for example, the flute, oboe, cornet, stringed instruments and other sounds, which while pleasing to the ear were quite unlike those emitted from any musical instrument with which we are familiar. The pitch of the notes is very easily regulated by changing the capacity or the inductance in the circuits, which can be very easily effected by a sliding contact or simply by turning the knob of the condenser. In fact, the pitch of the notes can be changed by merely putting the finger on certain parts of the circuit or even by holding the hand close to parts of the circuit. In this way very weird and beautiful effects can be easily obtained.

"At the earlier stage of these investigations I found that the pitch of the note could also be varied by a simple

arrangement, such as a graphite pencil mark on a piece of paper or slate, connected across between parts of the circuit, and that this afforded the most ready means of altering the pitch and quality of the notes.

"Acting on these discoveries and suggestions, I found it was a comparatively simple matter to arrange a crude scale similar in function to that of an organ, with switches in place of the ordinary keys, so that by pressing certain keys I could cut out, or in, more or less inductance or capacity or resistance, thus changing the notes emitted from the telephone receiver at will.

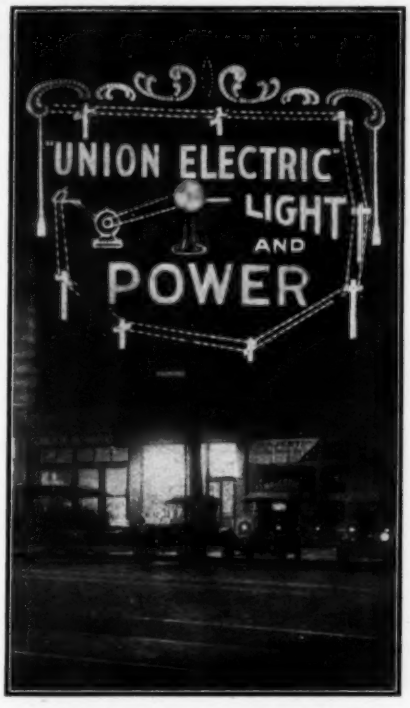
"In order to bring the volume of sound out large and full in the room, it was necessary to connect a number of loud-speaking horns connected with telephone receivers similar to those which one has sometimes heard in the central railroad stations as train announcers. With these horns distributed in different parts of my laboratory, or grouped together in one place, the sound can be made to emanate from all quarters of the room or from one corner, as I choose.

"In its simplest form, used as a detector for wireless signals, the audion is a small incandescent lamp about 1.5 inches in diameter, containing, besides the usual filament, a grid-shaped wire and behind that again a small rectangular plate of nickel, these elements being sealed inside the glass bulb, together with the filament. This bulb is perfectly insensitive until the filament is brightly lighted, whereupon it becomes, in connection with the aerial wire of any wireless receiving station, a detector of extraordinary sensitiveness.

"Now, this same little bulb which I have just described, in addition to being a receiver of wireless messages and an amplifier for long-distance wire telephones (in which use it is now employed on the transcontinental lines of the American Telephone & Telegraph Company) can be made to actually generate alternating current. It receives the energy which is expended in these currents from the battery or dynamo. The audion is, in other words, a transformer of energy. The alternating current, if of low frequency, can actuate the telephone diaphragm and make musical notes which the ear can hear, and this is the germ idea involved in the musical instrument which I have just described.

"At the present time I am using one bulb for an octave on the musical scale with the arrangement of keys and switches so that from this one bulb I can produce the notes of that octave by pressing the appropriate keys. For the next octave another bulb is used, and so on. The output of all these bulbs is made common to one set of telephone receivers or loud speakers so that the total energy in the form of sound is that of all the bulbs which are operating at any one time.

"In all my work with the audion—and I can imagine no device in the whole realm of practical physics of greater fascination than this little audion principle—I have never found any phase of its unlimited possibilities quite so interesting as this of producing musical notes. In the next twelve months I hope to be able to produce an instrument which will be far enough perfected so that I can turn it over to musicians to work out the thousand and one details of musical perfection which such men alone are capable of introducing."



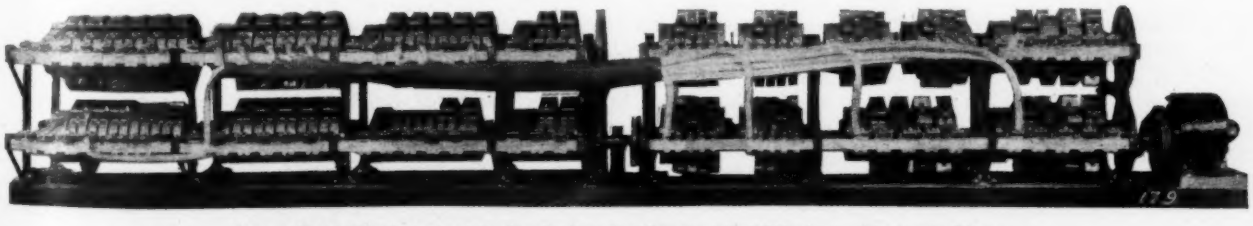
Spectacular Sign of St. Louis Central Station.

Spectacular Electrical Display Erected by St. Louis Central Station.

Probably the majority of central-station companies use some kind of electric signs for their own advertising with considerable success. In some of these signs ingenious spectacular features have been introduced, although like the shoemaker and the blacksmith of the proverb, the average electric light company contents itself with supplying energy for the clever moving displays of its customers in other fields, and does not realize the possibilities of flashed signs advertising its own wares.

A striking spectacular sign, advertising light and power service, has just been erected by the Union Electric Light & Power Company, of St. Louis, Mo., on the roof of a building at the turn of Broadway, near Morgan Street, where it commands a view of about 20 blocks of the former main thoroughfare. The spectacular features of the display depict, somewhat fantastically, of course, the electrical energy coursing over a transmission line and operating a motor-driven emery wheel against which a bar of iron is seen to be fed with an attendant display of bright sparks.

When the lights first come on, only the poles are seen outlined in red. Then as the flow of electricity is supposed to start, the line wires light up with a rapid progressive motion, in skyrocket fashion, encircling the sign, until the switch at the left is reached. This is then seen to throw in, and the motor, belt and emery wheel are shown in motion by means of flasher devices. Next the iron bar at the right is seen to move against the emery wheel, by an arrangement of lamps, and a series of sparks fly off from the point of contact, first white, then amber, and finally dying out to red at the extremities of their paths. Meanwhile, by means of a ripple effect, the "flow of energy" in the wires is seen, encircling the sign and entering the motor. The words "Union Electric Light and Power" next appear and remain a few seconds after the moving display has been extinguished. The other names appearing on the sign are those of merchants in the building below and that adjoining, whose good will it was necessary to obtain in order to erect the sign. The company, whose name appears at the



Large Reco Flasher Used in Producing the Spectacular Effects in St. Louis Sign.

top of the sign, was prevailed upon to remove its obstructing sign from the next building, in order to make this display visible, as this particular situation is probably the most conspicuous one in St. Louis for an electric sign.

This spectacular sign contains nearly 2,000 Mazda lamps of various colors. The sign itself measures 41 by 43 feet and the steelwork used in its construction weighs about 2,000 pounds. An idea of its size is gained from the accompanying illustration. All wiring is in conduit and the lamp sockets are inclosed in waterproof tin boxes forming the letters and signs.

The operation of the sign is controlled by a large Reco flasher having 53 switches. This flasher is driven by a one-eighth-horsepower Reco motor, and is inclosed in a weatherproof metal box, 11 by 2 by 3 feet, mounted on the roof. Four contacts are required for the sparks, 6 for the rotating devices, 12 for the ripple flow, 2 for the switch, 21 for the run of the pole line and 12 switches for the main circuits and signs. Color effects are obtained by the use of Reco color hoods on the lamps.

The difficulties of guying a large sign of this kind on the roof of an isolated narrow building were solved by erecting latticed bridge structures supported by struts, from which the sign is braced. The sign is a prominent spectacle from any point of the downtown business section of Broadway, and has occasioned the liveliest interest of passers-by.

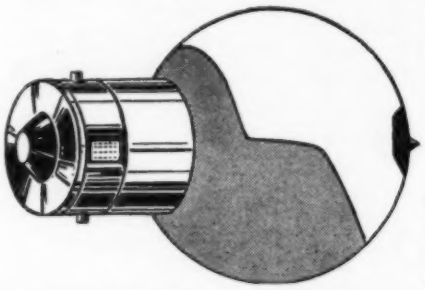
This sign was constructed and erected for the Union Electric Light & Power Company by the Brilliant Sign Company, of St. Louis, F. D. Beardslee for the former company and F. A. Kehl for the latter company and O. D. Ziegler, of the Reynolds Electric Company, having arranged the various details.

Glare-Free Electric Lamps for Automobiles.

Illustrated herewith is the Mac "Kno-Glare" swivel-bulb automobile lamp, which is creating considerable interest among motorists and dealers, and the manufacturers of incandescent lamps themselves, for it embodies not only a new principle of controlling electrical headlights and eliminating all dazzle and glare, but the base itself is said to be the only improvement made in Ediswan miniature lamp bases for many years.

As will be noted from the illustration, a portion of the lamp bulb is treated with a semi-translucent compound, this being placed upon the bulb in a peculiar form and in certain proportions. By means of this coating it is claimed by the manufacturer that the light rays emanating from the lamp filament are thoroughly diffused and the glare done away with.

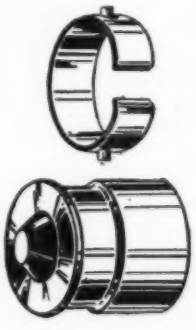
The base is, in size and dimensions, exactly the same as the standard Ediswan base, and will fit into any Ediswan socket of any make. The Mac lamp, however, has the pins which hold the lamp into the Ediswan socket mounted upon a separate ring, which fits into a recessed portion of the lamp



Mac "Kno-Glare" Automobile Lamp.

base. The lamp is installed identically the same as any other lamp, but when locked in the socket the lamp may then be rotated to bring the treated portion of the bulb to the bottom part of the reflector, this being done without necessitating changing of the positions of the socket, regardless of the year or make of car.

After the lamp has been properly placed in the socket and the current turned on, it will be noted that the clear portion of the lamp bulb, being at the top part of the reflector, permits the light rays from the filament to strike the upper portion of the reflector, from which they are reflected upon the roadway. The treated portion of the lamp bulb, however, being



Base and Ring of Mac Lamp.

at the bottom of the reflector, the light rays emanating from this part are subdued so that the light which would ordinarily be reflected upward, and which causes dazzle and glare, is softened, making it possible to look directly into a pair of headlights equipped with Mac "Kno-Glare" lamps without annoyance; the roadway, however, is said to be more brilliantly illuminated than would be the case if simply clear lamps were used.

These lamps are made in various candlepowers and voltages, in both single and double contact, for all makes of cars. The manufacturers claim to have the only device on the market which eliminates dazzle and glare, but does not decrease the driving light. The price of these lamps has been reduced on account of the heavy demand and increased production, until these goods are now sold to the consumer at only a slight advance over the ordinary cost of a clear lamp bulb. The manufacturers have been granted certificates from the state of New Jersey and various cities throughout the United States placing these lamps on the list of approved headlights.

When this product was originally marketed the lamps were supplied with the ordinary standard bases, but as some difficulty was experienced in installing the lamps, on account of the peculiar positions of the sockets in some cars, the new base was designed. In order that it may be thoroughly understood, it is illustrated separately, also the ring, thus making it easy to see the relation with the completed product.

The entire sales of this device are controlled by A. Hall Berry, 97 to 101 Warren Street, New York City.

New Novalux Units for Mazda Series Street Lighting.

At the present time more attention is being paid to street lighting and its problems than ever before. Municipalities are beginning to realize that good street lighting means a better, cleaner city, enhanced property values and civic progress. It is good business to have well lighted streets, good business for the merchants and property owners and good business for the city as a whole.

This growth of interest has been paralleled by activity on the part of the manufacturers, and wonderful advances have been made in both the development and application of street-lighting units. Among the most recent is the development of the new high-candlepower sizes of series gas-filled lamps. These lamps have efficiencies which were never before thought possible and make high-candlepower incandescent-lamp units practical.

Due to the high temperature of the bulb it is desirable to operate all lamps rated 400 candlepower or over in ventilated fixtures equipped with globes to protect the lamp bulb from the effects of moisture and atmospheric changes. Furthermore, the extreme concentration of the filament produces high intrinsic brilliancy and consequent glare unless globes of diffusing glass are used to conceal the light source and improve the distribution.

A new series of units has recently been added to the already comprehensive line of Novalux units made by the General Electric Company for the operation of the high-candlepower Mazda type C lamps, and they embody the latest ideas in design, both of an artistic and mechanical nature. These units have excellent light-distributing characteristics, giving the maximum light at the 10-degree angle below the horizontal, which is the best for effective street lighting.

These new units are made for use with the 5.5, 6.6 or 7.5-ampere straight series Mazda lamps, and for use with the 400-candlepower, 15-ampere and the 600 and 1,000-candlepower, 20-ampere Mazda series lamps. The units for operating the high-candlepower lamps are equipped with self-contained autotransformers or compensators, so that they can be operated on standard constant-current circuits of either 6.6 or 7.5 amperes.

New Pendent Novalux Fixture with Reflector and Prismatic Refractor.

A careful comparison shows that for the majority of installations the high-current series Mazda lamps with individual autotransformers are more efficient and economical to operate than low-current 6.6-ampere lamps of equal candlepower rating; furthermore, that the increased efficiency means increased capacity in constant-current transformers and other station equipment.

A Novalux unit with individual autotransformer for operating a 600-candlepower lamp at 20 amperes and equipped with a proper reflector gives about twice as much light as the 7.5-ampere carbon inclosed arc lamp, and consumes 30 per cent less energy. The station capacity is also increased by 30 per cent and a reserve capacity secured for possible extensions. No changes are necessary in the lines or cable and the same hangers and cutouts can be used, there being simply a substitution of lamp for lamp.

The new units are made in two different general types, one for mounting on brackets or permanent fastening to mastarms, while the other is for the regular method of suspension. These two types are termed the bracket and pendent types, respectively.

The bracket type is equipped with the same insulator that is used with the General Electric series incandescent brackets. This interposes an insulation between the unit and the pole which will withstand voltage strains up to 25,000 volts. This insulator has great mechanical, as well as electrical strength because it is composed of only one massive porcelain. In addition to this important feature, it is adapted for either open or concealed wiring of the unit.

For open wiring the units are furnished with flexible leads equipped with substantially soldered connectors of liberal cross section. The circuit wires can, however, also be brought directly into the fixture by simply bringing the leads to the tieing ears on the insulator and then through the porcelain to the interior binding posts.

For concealed wiring the leads can be brought through the bracket pipe, through the hood into the top of the insulator and then into the binding posts. The binding posts in the insulator are heavy copper castings, each one being equipped with two phosphor-bronze screws to prevent the possibility of loose connections, open circuits, or grounds.

The following three combinations of light-distributing equipment can be used with the pendent or the bracket types: No. 87 light Carrara outer globe; No. 87 light Carrara outer globe and 20-inch reflector; prismatic refractor and 20-inch reflector. The prismatic glass refractor is the most valuable device ever applied to a light source to increase the light at effective angles. Instead of cutting down the light from the bare lamp by absorption, it more than doubles the candlepower values at angles of from 10 to 15 degrees below the horizontal. The refractor is made of two sections of prismatic glass with the prisms facing each other on the inside, thereby presenting exterior smooth surfaces which will not collect dust or dirt.

One of the important novel features of the new units is the method of ventilation. The globe seat is made airtight. The air enters through the fine-mesh-protected openings under the lower flange of the casing near the globe, circulates around the socket, and leaves through fine-mesh-protected openings under the dome of the lamp. This method gives a liberal supply of cooling air but prevents the entrance of insects.

The globe holder is hinged to permit ready access to the lamp, and the globe-holding device holds the globe firmly and evenly against the globe seat, but is so constructed that it is independent of the retaining screw, thus preventing globe breakage from excessive tightening of the screw. The socket is of the skeleton type. The casing is made of spun copper with a black oxidized finish and is held to the dome by a bayonet joint and set screws. The reflector is made of steel with black enameled top and white fire-enameled reflecting surface.

Novalux Bracket Fixture with Reflector and Carrara Glass Globe.

Underground Electric Restaurant.

A large mining company has installed an electric restaurant 150 yards in from the foot of the shaft in one of its mines. Here food is cooked or heated electrically, and hot coffee is prepared by the same means. Since most of the important coal mines already use electric power underground for power purposes, there should be little difficulty in establishing subterranean electric restaurants in any of them.

A cent's worth of electric energy will lift 100 gallons of water 100 feet.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CINEMATOGRAPH PROJECTORS.—The Pathescope Company of America, 33 West Forty-second Street, New York, N. Y., submittor. Manufactured by Compagnie Generale d' Establishments Pathe Freres, Vincennes, France.

"Pathescope" portable miniature motion-picture machines, with incandescent lamps for illuminating elements. Rating 2 amperes, 120 volts.

Motor-driven model for alternating-current circuits; two types, in which lamp is in series with rheostat or connected to transformer respectively, and having single-phase induction motor, portable cord and attachment plug for use on ordinary lighting circuits.

Standard for use only with slow-burning films supplied by manufacturer.

Listed October 2, 1915.

CONDUIT OUTLET BUSHING AND FITTING.—The Gillette-Vibber Company, 32 Maple Avenue, New London, Conn.

Conduit Terminal Fitting—Gillette-Vibber Company.

Two-piece galvanized cast-iron terminal fittings with composition covers with wire openings for capping ends of rigid conduit. Catalog Nos. 10001, 10012, 10034. **(See cut.)**

Standard only for inside work, and only when secured to threaded ends of conduit with standard locknuts.

Listed October 12, 1915.

FIXTURE PARTS.—National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill.

National X-Ray Reflector Company fixture parts used in fixture construction.

Pendent fixtures for 100 and 200-watt Type C lamps, to be used with standard flexible cord having slow-burning insulation or asbestos covering, catalog Nos. 600, 610.

Listed October 6, 1915.

FUSELESS ATTACHMENT PLUGS.—General Electric Company, Schenectady, N. Y.

Separable and nonseparable attachment plugs, having porcelain or composition bases with porcelain, composition or brass-covered caps.

G. E. 660 watts, 250 volts, catalog No. GE624. With caps, catalog No. 49487.

Listed October 16, 1915.

FUSELESS ATTACHMENT PLUGS.—Simplex Electric Heating Company, Cambridge, Mass.

Cord connectors. Simplex, 20 amperes, 250 volts.

Single-heat: catalog No. 881; body only, catalog No. 891; plug only, catalog No. 871.

Bell-Ringing Transformer—Packard Electric Company.

Three-heat: catalog No. 883-S.

Listed August 14, 1915.

HEATERS, Electric.—General Electric Company, Schenectady, N. Y.

"G. E." heaters, 95-250 volts.

Tea kettles, types L-28, L-29, 220-575 watts.

Chafing dishes, type L-29, 600 watts.

Toasters, type D-56.

Disk stoves, types D-8, D-9, D-14, D-15, 225-900 watts.

Air heaters, type A-51.

Glue pots, type I-31.

Listed September 22, 1915.

HEATERS, Electric.—Wood, Nathan & Virkus Company, Incorporated, 30 East Twenty-third Street, New York, N. Y., submittor. Manufactured by The Prometheus Electric Company, 232 East Forty-third Street, New York, N. Y.

Virkotype machine, for supplying fresh printed matter to heat for a few seconds to glaze the ink. The printed paper, sprinkled with a special powdered compound, is fed on a motor-operated guide and carried between two stationary heating plates. 8.5 amperes, 220 volts; 17 amperes, 110 volts.

Listed September 23, 1915.

MUSICAL INSTRUMENTS.—J. P. Seeburg Piano Company, 209 South State Street, Chicago, Ill.

Automatic pianos and orchestras, operated pneumatically by motor-driven fan located at a remote point. Each instrument is provided with a switch to control self-starter of motor driving fan. A small motor of protected type is mounted within the case and is used to draw music roll over tracker board. These devices are intended primarily for use in motion-picture theaters.

Listed October 21, 1915.

PICTURE MACHINES AND APPLIANCES.—Atlas Education Film Company, 5 South Wabash Avenue, Chicago, Ill.

Arc lamp-house attachment, 40 amperes, 125 volts.

This device, for use with the Atlas Special Portable Hand-Operated Projector, consists of an arc lamp and lamp-house, 25-40-ampere, 110-volt rheostat, double-pole knife switch, and adjustable stand for the lamp-house and projector.

Standard for use with slow-burning film only.

Listed October 2, 1915.

PICTURE MACHINES AND APPLIANCES. — The Automatic Film Winder and Rewinder Company, 309 Market Street, Harrisburg, Pa.

The Horting rewinder. A cast-aluminum magazine mounted on a metal base and designed to inclose reels of films during rewinding process. An electric motor drives, by belt, one of reel spindles, and an automatic switch opens motor circuit when rewinding is completed.

Listed October 22, 1915.

SIGNS, Electric.—The Phelps Manufacturing Company, 265 Jefferson Avenue, Detroit, Mich.

"Baby" sign receptacle flashers, 60 watts and 100 watts, 110 volts, consisting of thermal element and lamp base mounted on porcelain base.

Listed October 12, 1915.

SOCKETS, Standard.—The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins metal shell.

Key, 250 watts, 250 volts, catalog No. BH-600.

Listed October 11, 1915.

TRANSFORMERS.— The Packard Electric Company, Warren, O.

Packard Belle bell-ringing transformers porcelain-clad. Type G. 1 to 25 cycles; Type D. 1 to 60 cycles. High voltage 110, low voltage 11. (See cut.)

Listed September 10, 1915.

Current Electrical News

ATLANTIC STATES.

JERSEY CITY, N. J.—The Board of City Commissioners is planning for the installation of a new street-lighting system, forming a "white way" on Ocean Avenue. Nitrogen-filled lamps will be installed. A.

KEYPORT, N. J. — The Public Service Railway Company is planning for the erection of a new substation at the Highlands. A.

LAMBERTVILLE, N. J. — The Lambertville Heat, Light and Power Company has been acquired by new interests and will be known as the Lambertville Public Service Company. The new owners are planning for extensive improvements in the electric power plant and distributing system.

STRATFORD, N. J.—The Borough Trustees are negotiating with the Clementon Electric Light Company fo the installation of an electric-lighting system throughout the town. A.

TRENTON, N. J.—The Board of City Commissioners has passed an ordinance providing for an expenditure of $27,500 for extensions and improvements in the fire and police alarm system, and telegraph underground system. A.

LANCASTER, PA. — The Berks-Lehigh Electric Company will shortly ask for a charter to supply light, heat and power by electricity in the township of Lower Macungie including the borough of Topton, Pa. Lawrence B. Myers, Edith H. Myers and John M. Groff, all of Lancaster, Pa., are the incorporators.

PHILADELPHIA, PA. — Complete electrical equipment will be installed in the Frankford High School and the Southern High School by the Board of Education. J. Horace Cook is the architect.

NORTH CENTRAL STATES.

BARBERTON, O.—The new park in West Barberton will be lighted by electricity, standards and lights at a cost of about $8.50 each being planned, after the extension of the lines to the park. Superintendent R. J. Long has charge of the installation. L.

EATON, O.—The Eaton Lighting Company has increased its capital stock from $50,000 to $80,000. A number of improvements and the extension of its service to Camden will be made. Address Judge Elam Fisher, president.

LIMA, O. — The proposed $60,000 bond issue for the construction of a municipal lighting plant to operate a comprehensive "white-way" lighting system was defeated at the election Tuesday, and some other plan may be adopted for the lighting system. L.

MASSILLON, O. — Improvements costing over $100,000 will be made by the Massillon Electric and Gas Company, on its plant in South Erie Street, within the next four months, according to T. O. Kennedy, general manager, who returned from New York Friday afternoon, where arrangements for the work were completed.

NEWARK, O.—Bonds have been voted for the reconstruction of the municipal plant, the amount being $30,000. L.

NASHVILLE, IND.—Bonds to the amount of $7,000 have been voted for a municipal light plant. Address village clerk.

DECATUR, ILL.—The Board of Local Improvements is considering a petition of property owners in North Main Street for the extension of an ornamental lighting system. The estimated cost is $6,377. Z.

PEORIA, ILL.—The board of supervisors has awarded the contract for electric-lighting fixtures for the new county jail to A. Kiefer, of Peoria. His bid for the work was $1,500. Z.

ORIENT, IOWA.—The council is considering the installation of a municipal electric-lighting system to cost about $7,000. Address city clerk.

BEVIER, MO.—Bonds in the sum of $12,000 have been voted for the purchase of an electric-light plant. Address the mayor.

KANSAS CITY, MO. — The city council recently passed over the mayor's veto, an ordinance providing for ornamental lights on Grand Avenue to Troost, a distance of nine blocks. M.

LITTLE RIVER, KAS.—Bonds for $16,000 have been voted and contract will be let November 15, for a municipal electric light plant including one 80-horsepower oil engine; a 50-kilowatt generator; a 300-ampere storage battery, etc. W. B. Rollins Company, of Kansas City, Mo., have made the plans.

CHANCELLOR, S. D.—Full twenty-four hour electric light service for Chancellor is to become a reality through the action of the town authorities in passing a resolution providing that plans for a municipally owned plant be secured and considered. The sum of $5,500 is to be expended by the town in carrying this project through.

MEDINA, N. D.—Plans are being considered for the installation of an electric-lighting system. Address city clerk.

SOUTH CENTRAL STATES.

PERRYVILLE, KY.—W. J. Debaun, of this city, has sold the local electric light and ice plant to Russell Brothers, of Washington County, who took possession on the first of November. The Debaun plant was recently established and has been very successful.

TYRONE, OKLA.—A state charter has been granted to the Tyrone Electric Light, Ice and Power Company, of Tyrone, Okla. The capital stock is $10.000.

WESTERN STATES.

HEDGEVILLE, MONT.—It is reported the proposition of installing a municipal electric light and water system is being given serious consideration by the town council, which recently asked the Billings Engineering & Contracting Company, of Billings, Mont., to furnish figures on the cost of constructing the improvement. O.

PROVO, UTAH. — Residents of Grand View ward, comprising the southern portion of Provo Bench, are making preparations to build a small power plant on Spring Creek to furnish light and power for domestic use for the residents of that village. Address city electrician.

BOISE, IDAHO.—It is announced that the Utah Power and Light Company is preparing to construct a second 10,000-kilowatt unit at its plant at Oneida, at a cost of about $250,000.

EMMETT, IDAHO.—The Electric Investment Company, of Boise, according to reports, will rebuild its electric light and power line in Emmett, work to begin in the immediate future. O.

KELLOGG, IDAHO.—Reported the Washington Water Power Company, of Spokane, Wash., will extend its electric power-transmission lines to two mining properties on Pine Creek, near this city, to serve the Constitution and Little Pittsburg mines. This company has extended its lines to several mining properties in this district. According to reports, other mining companies contemplate purchasing current to be used in operating their stamp mills, etc. O.

PETERSBURG, ALASKA. — The town council has commissioned Fred C. Purinton, here, to visit Seattle and other Puget Sound cities and investigate the proposition of converting the present coal oil lighting system into an electric lighting plant. O.

DAWSON, Y. T. — A recent fire totally destroyed the large steam generating plant of the Canadian-Klondike Mining Company, located here. Included in the loss was a battery of three large water-tube boilers, and a 400-kilowatt turbo-generator. According to reports, the plant will be rebuilt on an enlarged scale, at an early date. The plant was used for furnishing current to operate dredges, heating the company's shops, offices and general works. O.

CHEHALIS, WASH.—The holdings of the Washington-Oregon Corporation were sold October 30, in this city, to Harry N. Putnam, of Portland, who represented eastern bondholders of the organization. The price paid was $1,569,000. According to reports, the organization back of Putnam will take over the entire holdings of the Washington-Oregon Corporation under the name of the North Coast Power Company, which was recently organized at Vancouver, Wash. The following

properties located in all the principal towns and villages on the Northern Pacific main line in southwestern Washington, were included in the sale: Electric interurban line operating between Centralia and Chehalis; the power plant at Chehalis and on the Kalama River, near Kalama; other auxiliary plants which the company operates in this section. This company also controls nearly every electric light and power franchise in southwestern Washington. O.

FERNDALE, WASH.—The proposition of joining with the town of Custer, near this city, in inducing the B. C. Electric Company to extend its power transmission lines to Ferndale and Custer, thereby assuring a 24-hour service, is being considered by the city council. O.

PALOUSE, WASH. — Because a franchise granted 12 years ago to the Palouse Light and Power Company, now held by the Washington Water Power Company, of Spokane, expires this fall, this city has taken initial steps toward acquiring a municipally-owned and operated electric-lighting plant. Under the provisions of the franchise, the city has the privilege of taking over the property at any time during the next 12 months, at a valuation to be fixed by a board of appraisers. The city council has authorized city attorney McCroskey, and the members of the Public Utilities Committee to investigate the feasibility of the proposition. In case the committee recommends favorably, a special election will be called and bonds issued for the purchase and ultimate extension and improvement of the plant. O.

SEATTLE, WASH. — Bids have been called for by Seattle School District No. 1 for furnishing and installing electric light fixtures in the new Ballard High School building.

SEATTLE, WASH.—J. D. Ross, Superintendent of Lighting, states the municipal lighting department will petition the King County Commissioners for a franchise to extend its transmission lines and to furnish municipal current to the southern half of King County. The commissioners recently granted a similar franchise to the Puget Sound Traction, Light and Power Company, and the franchise granted to the corporation contains a common user clause, which will permit the city or any lighting company to use the poles of the corporation which holds the franchise. O.

SEATTLE, WASH. — After Mayor H. C. Gill vetoed the bill providing for the appropriation of $25,000 to be used in sealing the Cedar River impounding basin, he recommended that immediate steps be taken to construct a power plant at Landsburg, near Cedar Falls, where engineers claim between 40,000 and 60,000 kilowatts can developed under the most favorable circumstances. Willingness to consider Mayor Gill's recommendations has been evinced by the City Utilities Committee of the council. Mayor Gill proposes the Landsburg plant as an auxiliary to the municipal lighting plant, which has insufficient power to care for the growing needs of the city lighting plant, and he asserts that the plant can be built and in operation before the impounding basin can be sealed. O.

TACOMA, WASH. — The Home Electric Company, 924 Commerce Street, Tacoma, has been awarded the contract by Superintendent of Lighting Collins for $10,000 worth of electric lamps to be used by the municipal lighting plant. O.

TOPPENISH, WASH.—G. I. Drennan, local manager of the Pacific Power and Light Company, states his company will make an important extension of electric transmission lines to serve the district extending from Parker to Buena Station, including the territory around Sawyer. By this extension, the company will add 75 new lighting customers and will make power installations at several ranches in the vicinity of Parker and Buena.

ESCONDIDO, CAL. — An election has been called to vote on the proposition of issuing bonds to the amount of $40,000 for the installation of a municipal electric-lighting plant.

MANHATTAN BEACH, CAL. — The City Trustees have called for bids for furnishing and installing posts, wires, etc., for the electric lighting of Fifth Street.

REDDING, CAL.—Plans have been tentatively adopted for a new electric lighting system to cost about $3,000.

PROPOSALS.

ELECTRIC MOTORS AND APPURTENANCES. — Sealed proposals will be received by the city November 18, at Room 710 City Hall, Chicago, Ill., for fabricating and delivering at the Municipal Reduction Plant, of the city, located at Thirty-ninth and Iron Streets, electric motors, appurtenances and accessories, according to plans and specifications on file in the office of the Department of Health. Address John Dill Robertson, Commissioner of Health.

ELECTRIC LIGHT PLANT. — Sealed bids will be received by W. H. Copeland City Clerk, New Madrid, Mo., up to 7:30 P. M., on Monday, November 29, 1915, for additions to electric light plant for the City of New Madrid, New Madrid County, Missouri. H. H. Humphrey, 1312 Chemical Bldg., St. Louis, Mo., consulting engineer.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 19,029. POCKET ELECTRIC LAMPS.—A commercial organization in the United States transmits the name of a firm in France which desires quotations on pocket electric lamps, hardware, and sanitary articles for surgeons and hospitals.

NO. 19,039. WIRE MACHINERY. —A commercial organization in the United States transmits the name of a man in Spain who desires to establish connections with American manufacturers of machines to cover wire with silk. A sample has been forwarded, which may be seen at the Bureau or its branch offices.

NO. 19,055. X-RAY APPARATUS AND ACCESSORIES.—An American consular officer in Spain writes that a man in his district wishes to communicate with American manufacturers of X-ray apparatus and accessories. Correspondence should be in Spanish.

NO. 19058. ELECTRIC LAMPS, ETC.—A commercial organization in the United States transmits the name of a man in Spain who desires to establish connections with American manufacturers of electric lamps, and machinery. Correspondence should be in Spanish.

NO. 19,099. ELECTRICAL GOODS. —The commercial attaché of the Department of Commerce in China writes that a firm in that country desires to establish connections with American manufacturers of electrical wires, fixtures, batteries, and lamps of the cheaper class.

NO. 19,107. ELECTRIC FLASHLIGHTS.—An American consular officer in the United Kingdom reports that a firm in his district is desirous of importing electric flashlights or torches, particularly vulcanite torches, complete with lens, etc. Sizes desired are 1.25 by 5 inches, 1.5 by 6.5 inches, and 1.5 by 8.5 inches. Descriptive literature should be sent with quotations.

FINANCIAL NOTES.

The Interstate Electric Corporation has authorized an increase of its capital stock by the issue of $1,000,000 seven-per-cent preferred stock, of which $500,000 will be sold at once and the proceeds applied towards the purchase of three additional electric properties in Texas.

E. H. Rollins & Sons and William P. Bonbright & Company, Incorporated, New York City, have purchased jointly $4,500,000 ten-year six-per-cent convertible debentures of the Great Western Power Company, of California.

It is stated that Commonwealth Edison, Chicago, early next year, will issue $4,500,000 new stock to stockholders at par for new turbines and other improvements in connection with construction work on the north side of the city.

Dividends.

	Term	Rate	Payable
Am. Ry., com	Q	1 %	Dec. 15
Cent. Ark. Ry. & Lt. Corp., pf.	Q	1.75%	Dec. 1
Detroit United Ry	Q	1.5 %	Dec. 1
Ill. Traction, com	Q	0.75%	Nov. 15
Kings Co. Elect. Lt. & Pr.	Q	2 %	Dec. 1
Wash.-Va. Ry.	S	2.5 %	Nov. 1

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK

	Nov. 8	Nov. 1
American Tel. & Tel. (New York)	128	124⅝
Commonwealth Edison (Chicago)	140	140
Edison Electric Illuminating (Boston)	238	238
Electric Storage Battery, common (Philadelphia)	71	72½
Electric Storage Battery, preferred (Philadelphia)	71	72½
General Electric (New York)	177	181⅞
Kings County Electric (New York)	120	120
Massachusetts Electric, common (Boston)	7	7
Massachusetts Electric, preferred stamped (Boston)	40	40
National Carbon, common (Chicago)	150	150
National Carbon, preferred (Chicago)	121	121
New England Telephone (Boston)	132½	132½
Philadelphia Electric (Philadelphia)	29¼	27
Postal Telegraph and Cables, common (New York)	83	79½
Postal Telegraph and Cables, preferred (New York)	65¾	65
Western Union (New York)	87¾	80⅝
Westinghouse, common (New York)	69	72⅝
Westinghouse, preferred (New York)	143	140

NEW PUBLICATIONS.

MAGNETISM. — An address by George F. Stradling delivered before the Franklin Institute and the Philadelphia Section of the American Institute of Electrical Engineers last April entitled "Modern Theories of Magnetism," has been reprinted in pamphlet form from the Journal of the Franklin Institute.

MAGNETIC PERMEABILITY. — Technical Paper No. 245 of the Bureau of Standards is entitled "Temperature Coefficient of Magnetic Permeability Within the Working Range," by R. L. Sanford. For precise work, variations with temperature must be considered, but no definite and permanent coefficients seem to exist.

TORONTO SYSTEM.—The fourth annual report of the Toronto Hydro-Electric System for the year 1914 has been issued by the commissioners of the city of Toronto. It gives a financial statement of the operation of the city system, with a report of the general manager, H. H. Couzens, and statistics of the output.

BUREAU OF STANDARDS.—The Bureau of Standards, Washington, D. C., has issued technical papers No. 256 entitled "Construction of Primary Mercurial Resistance Standards," by F. A. Wolff, M. P. Shoemaker and C. A. Briggs, and No. 257 entitled "Note on the Resistance of Radiotelegraphic Antennas," by L. W. Austin.

TELEPHONE TRANSMISSION LOSSES.—Reports Nos. 16 and 17 of the second section of the Electrotechnical Laboratories, Tokyo, Japan, are entitled "Transmission Losses in Common-Battery Subscriber's Loops," and "Transmission Losses in Telephone Lines," by M. Tonegawa and T. Arakawa.

NEW INCORPORATIONS.

CLEVELAND, O.—The Domestic Electric Company has been incorporated with a capital of $17,000 by Harry T. Gettins, B. S. Soden and others.

LEBANON, VA.—The Lebanon Light Company has been incorporated with a capital of $5,000, to operate a light plant in Lebanon. E. R. Combs is president of the company.

RIO GRANDE CITY, TEX.—The Rio Grande City Ice, Water and Light Company has been organized with a capital stock of $24,000. It will build a water and light plant and an ice factory. R. R. Margo is interested.

CHICAGO, ILL.—The Service Electric Company has been incorporated to manufacture and deal in electrical and mechanical appliances. The company's capital stock is $6,000, and the incorporators are William F. Gresham, Ethel W. Downes and Douglas C. Gregg. Z.

KALISPELL, MONT.—The Mission Range Power Company has filed articles of incorporation with the county. The company is organized for the purpose of furnishing electric power for the city of Polson. The company is incorporated for $100,000, with paid-in capital of $51,000. The officers of the company are: J. H. Cline, of Polson, president; J. A. Johnson, treasurer, and C. E. Wood, secretary.

BLACK HAWK, WIS.—The Valley Electric Light and Power Company; capital, $7,500; incorporators. A. George Barber, Oscar A. Jaeger and Lucile Barber.

PERSONAL MENTION.

MR. F. S. MONTGOMERY, advertising manager of the National Metal Molding Company, Pittsburgh, Pa., has been elected treasurer of the Pittsburgh Publicity Association.

MR. A. S. LANGSDORFF, dean of the School of Electrical Engineering, Washington University, St. Louis, Mo., who was operated on for appendicitis on October 20, has left the hospital and is reported to be doing very nicely. He will recuperate for a few weeks at a health resort in Arkansas.

MR. PAUL M. LINCOLN, whose term as president of the American Institute of Electrical Engineers, expired july 1, 1915, and who has for a number of years been prominently identified with the engineering department of the Westinghouse Electric and Manufacturing Company, has resigned his position with this company in order to be able to devote his time to the manufacture of a meter which he has recently invented. Mr. Lincoln graduated from the Ohio State University in 1892. Shortly afterwards he entered the employ of the Short Electric Company, in Cleveland, learning first hand the operation of street railways, and becoming familiar with the difficulties encountered in operating electric cars on steep grades with small generators in the power house. He then joined the Westinghouse Electric and Manufacturing Company and was engaged in the testing room and in general engineering work. At the opening of the Niagara Falls Power Company's plant he became its electrical superintendent, and was thus identified in the early and notable days with the first great power plant in this country. He had much to do with the first transmission line to Buffalo, which in the amount of power transmitted and distance traversed was the greatest line of its time. In 1902 he returned to the Westinghouse company where his operating men has proven of great advantage in his work in connection with the general engineering of power stations and transmission lines. For several years he was in charge of the power engineering department in which position he supervised the design of a large amount of generating and converting apparatus. On the organization of the great engineering department, he was transferred to this department where his large acquaintanceship with operating conditions and operating men has proven of great value. He has thus been identified with the formulation of many of the large projects of recent years and has come into contact with operating conditions, as well as those pertaining to the design and performance of apparatus. In the American Institute of Electrical Engineers he has presented numerous papers, and was one of the members of the Transmission Committee which began its work a dozen years ago. To the work of this committee, through meetings and discussions, and through reports and published data, is due, in no small measure, the rapid and successful advance in power transmission. At the time of the appointment of that committee not quite twelve years ago, there was no plant in the country operating above 40,000 volts. He has served on many committees, notably by holding the chairmanship of the Committee on Local Organization for five consecutive years. This has brought him into intimate touch with the conditions and Institute needs in all parts of the country, while his service on the board of directors has acquainted him with internal Institute affairs. As an educator he is professor of electrical engineering in the University of Pittsburgh. In the field of technical journalism he has been a member of the publication committee of the *Electric Journal* for a number of years. Mr. Lincoln is a positive, definite, original thinker. Among those who have been most intimately associated with him, as well as those whose acquaintance with him is slight, or only through his writings, there is a regard and respect for his opinions and for the straightforward and frank way in which he is ready to express them.

OBITUARY.

MR. A. W. FIELD, charter member and first president of the Ohio Electric Light Association, in 1895, died at Detroit, Mich., on October 21. He was born in Columbus, Ohio, in 1851.

MR. ALBERT C. HUEBNER, for the past three years sales representative of the insulated wire department of the B. F. Goodrich Company, Chicago, Ill., was killed in an automobile accident at Akron, O., on Saturday, October 30. The car in which he was riding, through the fault of the steering gear, swerved from the road and turned completely over, pinning Mr. Huebner under the car. He was 31 years old and has held several important positions, including the post of secretary to the president of the Philadelphia Rapid Transit Company. He was well known in the trade, and had many friends in Chicago, where he last served the Goodrich Company. His widow survives him, and also his father and mother, Mr. and Mrs. Paul Huebner, of Philadelphia.

MR. P. A. B. WIDENER, financier and former street railway magnate, died on November 6, at his home, Lynnewood Hall, Elkins Hall, Philadelphia, Pa. He was 80 years old. Mr. Widener was one of the most widely known financiers in America, one of the powerful groups which controlled traction interests all over the country. The last years of his life were shadowed by the loss of his son, George Widener, who perished aboard the *Titanic*. His estate is valued in the neighborhood of $100,000,000. Mr. Widener was born in Philadelphia on November 13, 1834, and after receiving a public school education started his business career as a butcher. He soon became interested in politics and for more than 20 years he bore an active part in all the important political movements in the city. In 1874 Mr. Widener entered on the life which made him conspicuous in the financial affairs not only of Philadelphia, but of the entire country. He began by buying a few shares of street railway stocks here and there, and finally became the controlling factor of all the Philadelphia street railways. In 1890 Mr. Widener, in association with the late William L. Elkins, William C. Whitney, Thomas F. Ryan, Charles T. Yerkes and others, began to seek railway control in other cities, and in a few years the lines of New York, Chicago, Pittsburgh, Baltimore and other

cities came under their domination. Mr. Widener was active in the formation of the United States Steel Corporation and the American Tobacco Company. Mr. Widener has given large sums to charity. Since his wife's sudden death in 1896 his great ambition seemed to have been to commemorate her name, more than $11,000,000 having been spent on memorials. Among them are the Josephine Widener memorial branch of the Philadelphia free library and the Widener Industrial Home for Crippled Children.

DATES AHEAD.

Mississippi Electric Association. Annual convention, Hattiesburg, Miss., November 12-13. Secretary, H. F. Wheeler, Hattiesburg, Miss.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Zanesville, O., November 18 and 19. Secretary, Frank E. Sanborn, Ohio State University, Columbus, O.

American Society of Mechanical Engineers. Annual meeting, New York City, December 7-10. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York City.

National Independent Telephone Association. Annual convention, Hotel La Salle, Chicago, December 8-10. Secretary, F. B. MacKinnon, Washington, D. C.

American Association of Engineers. First annual convention, Hotel La Salle, Chicago, Ill., December 10-11. Secretary, Arthur Kneisel, 29 South La Salle Street, Chicago, Ill.

American Institute of Chemical Engineers. Winter meeting, Baltimore, Md., January 12-15, 1916. Secretary, J. C. Olson, Cooper Union, New York, N. Y.

With the Electrical Manufacturers

The General Insulate Company, Brooklyn, N. Y., has appointed as Pacific Coast agents the Dean Electric Company, 212 West Third Street, Los Angeles, Cal., and P. Seiler Electric Works, 324 Market Street, San Francisco, Cal.

Harvey Hubbell, Incorporated, Bridgeport, Conn., has got out several leaflets on its handy electrical devices. One of these describes and illustrates Hubbell attachment plug No. 50,815, said to be the smallest two-part plug on the market. Another is devoted to Hubbell lamp guards, of which eight types are illustrated; the locking guard with its many advantages is particularly featured.

E. T. Chapin & Company, Spokane, Wash., manufacturer and distributer of western red cedar poles, posts and piling, has opened a branch sales office at 2008 Railway Exchange, St. Louis, and a storage yard at Minneapolis, Minn., where a large supply of western red cedar poles will be carried in stock. These new facilities enable the company to get into closer touch with customers and prospective customers in the south and middle west and to supply their wants with the greatest dispatch.

The M. W. Dunton Company, 150 Niagara Street, Providence, R. I., has issued a new edition of "Soldering Kinks." This is a 31-page book, containing nearly 70 valuable suggestions on soldering all kinds of things. Many of the kinks suggest the use of Nokorde, the company's well known soldering paste. Among the kinks are quite a few that should be of interest to electricians. Copies of the book can be obtained from the company by sending postage.

The Globe Stove & Range Company, Kokomo, Ind., has issued an attractive booklet on electric cooking. It is printed in two colors and handsomely illustrated; a neat three-color cover is designed to invite the attention of housewives. The booklet sets forth the practicability of electric cooking and points out its many important advantages. The various types of Globe electric stoves, ovens and ranges are briefly described and their merits modestly proclaimed.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just had prepared for distribution to the electrical trade a four-page folder, printed in two colors, which deals with six-ampere pull switches. The switches described and illustrated are of the ceiling, pendent, and threaded-cap types, the shells being interchangeable with C-H 660-watt sockets. The principal point brought out in this circular is the fact that the capacity is just double that of any other pull switch on the market.

Spray Engineering Company, 93 Federal Street, Boston, Mass., has had reprinted as a 24-page illustrated book the paper on "Cooling Ponds for Condensing Engines," which was presented by Lee H. Parker before the recent convention of the National Association of Cotton Manufacturers. This paper gives a historical review of the development and use of cooling ponds. The spray system for increasing the efficiency of such ponds is described in detail. It is shown that the spray system dissipates about 36 times as much heat as a natural cooling pond with partitions and it increases the capacity of the plant it can take care of in the same ratio.

Safety-Armorite Conduit Company, Bailey-Farrell Building, Pittsburgh, Pa., announces that on November 3 a change was made in its selling organization affecting New York City and state, Philadelphia, Baltimore, Washington and adjacent districts. Heretofore its goods in that territory were marketed by a firm of selling representatives, while hereafter the company will look after such business direct. The company believes that direct selling will permit it to give better service. The eastern office will be located at 1670 Hudson Terminal Building, 50 Church Street, New York City, and will be in charge of William G. Campbell, a gentleman well known throughout the electrical industry.

Simplex Electric Heating Company, Cambridge, Mass., is sending out to dealers of its heating appliances two booklets of much interest. One of these is a 24-page book, entitled "Simplex Electric Household Devices." This contains large illustrations of the principal appliances of this line and should serve the dealer by aiding him in giving a better idea of the handsome appearance of these devices than can be obtained from the smaller cuts in the regular catalog; thus sales are facilited in cases, where the actual articles are not in stock. Another booklet intended for general distribution, deals very attractively with Simplex appliances that can be used in the dining or tea room and connected to any lamp socket. This 12-page booklet is printed by the rubber-offset color process and is illustrated with views showing the convenience and utility of these devices in the home. The merits of these products are cleverly and convincingly set forth, which should make the booklet of great value in any sales campaign, particularly that connected with Electrical Prosperity Week.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces a number of changes in the Supply Department, which have recently been put into effect. S. A. Chase, formerly special representative, T. J. Pace, formerly in charge of the illuminating and rectifier divisions, and Carl G. Schluederberg, formerly head of switchboard sales, have been appointed assistants to the manager of the department, J. J. Gibson. C. E. Stephens, engineer of lighting, has been appointed manager of the illuminating section to succeed Mr. Pace. C. Streamer, formerly head of the order division, succeeds Mr. Schluederberg as manager of the switchboard section, and A. P. Joseph is appointed head of the order section to succeed Mr. Streamer. M. C. Morrow, formerly of the Philadelphia office, is appointed manager of the appliance section, which is a combination of the former heating, fan motor and ozonizer divisions of the Supply Department. M. C. Rypinski, formerly manager of the Detail and Supply Division of the New York office, becomes manager of the meter section. The Power Department, of which E. H. Sniffin is manager, also announces the following section managers: W. H. Garrett, in charge of contracts; J. G. Worker, stokers, and H. D. Storer, auxiliaries.

Record of Electrical Patents

Issued by the United States Patent Office, November 2, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,158,421. **Percolating Device.** T. Abtmeyer, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Comprises an immersion electric heater combined with percolator pump, etc. (See cut.)

1,158,426 and 1,158,427. **Electric Switch.** F. Barr, New York, N. Y. First patent: Wall light switch has condition indicator operated by oscillating switch lever. Second patent: Spring-operated for lamp sockets.

1,158,428. **Pull Switch.** F. Barr, Woodhaven, N. Y. Details of spring-operated lamp-socket switch.

1,158,441. **Rectifier System.** D. E. Carpenter, assignor to Westinghouse Electric & Mfg. Co. Maintaining electrode has reactance in series in its circuit and incandescent lamp in shunt to reactance and maintaining arc.

1,158,451. **Electrical Hot-Plate.** R. W. Davenport, assignor to Detroit Stove Works, Detroit, Mich. For stove top.

1,158,463. **Method of Assembling Core Structures for Dynamo-Electric Machines.** G. M. Eaton, assignor to Westinghouse Electric & Mfg. Co. Sides of notches in laminae are caused to firmly grip securing key.

1,158,473. **Electric Animal-Prod.** W. B. Floyd, assignor of one-half to H. C. Hermsmeyer, Fort Worth, Tex. Has contacts at one end for pressing against animal and battery and induction coil mounted in handle.

1,158,474. **System of Current Rectification.** C. LeG. Fortesque, assignor to Westinghouse Electric & Mfg. Co. Arrangement of transformers and mercury rectifiers in connection with a two-phase circuit.

1,158,475. **Self-Serving Table and Heater.** W. J. Fox, San Diego, Cal. Revolvuble center has electrically heated disks.

1,158,486. **Electrically Heated Boiler.** W. S. Hadaway, Jr., and E. E. Rose, assignors to Westinghouse Electric & Mfg. Co. Protective mounting of resistance heating units extending through liquid tank.

1,158,487. **Resistance Element.** W. S. Hadaway, Jr., assignor to Westinghouse Electric & Mfg. Co. Integral resistance unit for flatiron has zig-zag conductor arranged to intensify heating effect at iron point.

1,158,488. **Electrical Apparatus.** W. S. Hadaway, Jr., and E. E. Rose, assignors to Westinghouse Electric & Mfg. Co. Mica-covered resistor inclosed in flexible insulation, all within metal armor and the whole pressed together.

1,158,491. **Secondary-Battery Element.** E. Handler, Baltimore, Md., assignor to General Industries Co. Nonconducting, two-part grid for supporting active material has conductors running to each material-holding pocket.

1,158,492. **Circuit-Interrupter.** F. W. Harris, assignor to Westinghouse Electric & Mfg. Co. Oil-switch contact mounting and operating devices for equalizing contact pressure.

1,158,495. **Induction Motor.** R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Structure of stator with core having staggered groups of plates.

1,158,502. **Automobile Clock.** R. S. James, Seattle, Wash. Alarm clock having an alarm circuit also controlled by manual switch.

1,158,511. **Polyphase Synchronous Motor.** B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Distributed field winding with resistance connections for starting, and short-circuiting and exciting connections for running.

1,158,512. **Two-Speed Induction-Motor Winding.** B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Arrangement of end connections of windings of different pitch.

1,158,516. **Electrode for Arc Lamps.** G. M. Little, and B. J. Gudge, assignors to Westinghouse Electric & Mfg. Co. Manner of securing metallic end extension to rod of refractory material.

1,158,532. **Commutator-Turning Tool.** J. Moles, assignor to The Eureka Co., North East, Pa. For turning the interior surfaces of assembled commutation bars.

1,158,534. **Switch Box.** T. E. Murray, New York, N. Y. Has sliding block of insulation carrying movable contacts with spring tending to open and extension to outside of casing adapted to be sealed or locked in closed position.

1,158,535. **Cutout Switch.** T. E. Murray. Fuse forming switch element movable with hinged casing cover is removable.

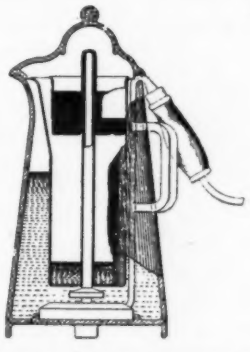
1,158,537. **Cash-Register.** W. H. Muzzy, assignor to National Cash Register Co., Dayton, O. Electric motor completing movement of coin-actuated levers and operating check-delivering levers, is controlled by coin-actuated movement of former levers.

1,158,539. **Electric Immersion Heater.** H. A. Newcomb, assignor to Westinghouse Electric & Mfg. Co. Buoyant arrangement closes circuit on immersion and opens on removal.

1,158,543. **Electric Drill.** R. A. Norling, assignor to Aurora Automatic Machinery Co., Aurora, Ill. Mounting of motor in casing of hand drill.

1,158,557. **Electrically Heated Implement.** E. E. Rose, assignor to Westinghouse Electric & Mfg. Co. Flatiron has heat-storing, air-insulated body in which resistor is mounted, resistor being covered by the iron face of good heat-conducting material.

1,158,565. **Induction Meter.** G. A. Scheeffer, Indianapolis, Ind. Arrangement of



No. 1,158,421.—Electric Immersion-Type Percolator.

pressure and series magnets in disk instrument.

1,158,572. **Electrical Resistance Device.** A. Simon, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Dissipation of heat from grids facilitated by radiating to heat-absorbing bodies and cooling latter.

1,158,578. **Dash and Trouble Lamp for Automobiles.** J. C. Stearns, Worcester, Mass. Special structure of socket and plug.

1,158,586. **Electric Heating Apparatus.** F. Thornton, Jr., assignor to Westinghouse Electric & Mfg. Co. In liquid heating device, supply of liquid and circuit of heater is float-controlled.

1,158,587. **Apparatus for Printing Cinematograph Films.** J. E. Thornton, London, England. Utilizes mercury-vapor lamps.

1,158,593. **Spark Plug for Internal-Combustion Engines.** W. D. Vandecar, Grand Rapids, Mich. Casing extends within cylinder and comprises sparking chamber between main core and auxiliary core in inner end of casing, spark gaps being between central electrode and conductor carried by auxiliary core.

1,158,597. **Combined Engine-Starter, Dynamo, and Ignition Timer for Automobiles.** G. R. Wadsworth, assignor to Gray & Davis, Boston, Mass. Electric starting motor connected with dynamo, timer and engine shaft by over-running clutch so that motor may rest and engine drive dynamo and timer.

1,158,598. **Commutating Device for Dynamo-Electric Machines.** M. Walker, assignor to Westinghouse Electric & Mfg. Co. Manner of excitation of interpoles.

1,158,600. **Handle for Illuminating Diagnostic and Surgical Instruments.** R. H. Wappler, assignor to American Cystoscope Makers, New York, N. Y. Comprises battery, variable resistance and contacts for effecting connection with instrument carrying lamp.

1,158,617. **Ship Propulsion.** H. Zoelly, assignor to Escher, Wyss & Co., Zurich, Switzerland. Has two sets of propellers for different speeds, one driven by turbine and other by turbo-electric motors with provision preventing dragging of one set when other is driving.

1,158,620. **Horn for Automobiles and Motorcycles.** S. A. Beyland, assignor to Garford Mfg. Co., Elyria, O. Special structure of device having electromagnetically operated diaphragm.

1,158,636. **Telephone System and Individual Transmitter Therefor.** C. L. Chisholm, assignor to the Chisholm Transmitter & Telephone Instruments Co., Marysville, N. B., Canada. Portable telephone transmitter comprising microphone element and collapsible mouthpiece mounted in case like a watch.

1,158,665. **Electric Telegraph Apparatus.** J. A. Elms, Somerville, Mass. Multiplex system.

1,158,682. **Electric Motor Time-Controller.** C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. For registering the maximum consumption of electricity.

1,158,708. **Electric Circuit Connector.** W. P. Mulligan, assignor of one-half to A. Ross, St. Paul, Minn. Connections with car-coupling heads having swinging and lateral movement.

1,158,709. **Variable-Rate Metering Mechanism.** G. H. Myrick, assignor to Chicago Electric Meter Co. Gear ratio is changed when consumption exceeds predetermined amount.

1,158,714. **Coupling.** G. O. Parker, Tampa, Fla. For connecting ends of trolley wires.

1,158,723. **Electric Steam and Hot-Water Radiator.** J. D. Ross, assignor of one-half to C. T. Swett, Portland, Me. Mounting of electric heater at bottom of radiator.

1,158,724. **Electric Radiator.** J. D. Ross, assignor to Electrical Steam Radiator Co., Portland, Me. Modification of above.

1,158,729. **Automatic Circuit-Maker and Breaker.** M. Scholl, Houston, Tex. Contact made through worm and contact piece moved along same against spring pull as worm turns.

1,158,731. **Shade-Holder.** E. J. Schroeder, Jersey City, N. J. Shade-holding petticoat surrounding lamp socket secured to cap by specially strengthened means, cap being rotatably mounted above socket.

1,158,734. **Train-Stopping Apparatus.** J. H. Skinner and D. E. Riley, Allegan, Mich. Special means to protect against rear-end collisions in sectional-conductor block system.

1,158,742. **Fire-Alarm Box.** N. H. Suren, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Details of particular mechanism.

1,158,749. **Electrical Switch.** A. A. Tirrill, Pittsburgh, Pa. Details of push-button wall switch.

1,158,762. **Ignition Apparatus for Explosion Engines.** F. B. Williams, assignor to Elkhart Mfg. Co., Monroe, Mich. Magneto-driving mechanism.

1,158,768. **Meter Case.** F. W. Andrews, assignor to Westinghouse Electric & Mfg. Co. Structural details.

1,158,781. **Revolving Safety-Razor and Massage Mechanism.** G. L. Bonham, West Hartford, Conn. Has driving motor in handle.

1,158,810. **Induction Coil for Telephone Lines.** S. B. Kent, assignor to Western Electric Co., New York, N. Y. Has core formed in separate sections spaced by insulating material and electrically connected by non-magnetic pins.

1,158,821. **Railway-Signal-Recording Device.** N. Lombard, Worcester, and W. E. Lombard, Arlington, Mass. Records operation of signal and also passage of trains.

1,158,824. **Mechanism for Raising and Lowering Shutters or Curtains.** E. H. McCloud, assignor to Kinnear Mfg. Co., Columbus, O. A number of curtains are selectively operated from electric motor-driven shaft and each curtain automatically controls reversing of motor.

1,158,834. **Vibratory Electric Bath-Blanket.** H. D. Parker, assignor of one-half to E. H. Phillips, Buffalo, N. Y. Layers of flexible material are stitched together and annealed steel resistor is between stitch rows; for connection to alternating-current circuit.

1,158,842. Protecting Device for Vapor Electric Apparatus. J. C. Pole, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. For preventing passage of current in reverse of desired direction in quartz lamp.

1,158,876. Controlling Means for Ignition Systems. L. C. Watson, and E. F. Boyer, Kansas City, Mo. Adjustable driving connection for advancing or retarding movable timer member.

1,158,894. Battery Well. C. A. Christofferson and W. M. McClintock, St. Paul, Minn. For signal cells; structure of metallic shell and fittings for burying in ground.

1,158,896. Protected Electro-Service Cut-out. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. Terminal clips on plate in bottom of box are engaged by clips on plate on hinged cover connected by fuse plugs, lifting of lid opening circuit and giving access to plugs.

1,158,898. Electrically Operated Device. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Special structure of magnet for operating vibratory contact.

1,158,899. Electric Furnace Intended Chiefly for the Manufacture of Nitrids. G. Coutagne, Lyon, France. Lower electrode is tubular carbonaceous block filled with coke and forming part of furnace base.

1,158,927. Automatic Telephone System. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Line and release relays for line switch initially energized by call, provision being made for continuing operation of line switch to select idle selector, line relay being thereupon de-energized, and release relay being de-energized on hanging up.

1,158,928. Terminal for Mercury-Vapor Apparatus. F. G. Keyes, assignor to Cooper Hewitt Electric Co. Platinum tube with core of iron is sealed in glass thimble and a cap fits about thimble and tube and is fused to thimble, the cap, tube and core being welded together.

1,158,930. Terminal Clip for Electrical Conductors. A. Klingner, assignor to A. R. Mosler & Co., Mount Vernon, N. Y. For securing to end of insulated conductor.

1,158,951. Impulse-Producing Mechanism. H. Pfannenstiehl and A. H. Adams, assignors to Western Electric Co.. For automatic telephone; contact device operated by finger disk is provided with governor controlling speed of operation.

1,158,954. Electrical Indicating and Regulating Apparatus. V. G. Apple, and G. B. Sayre, assignors to Apple Electric Co., Dayton, O. Special electromagnetic device governing connection of dynamo with battery circuit.

1,158,955. Switch. V. G. Apple and W. S. Miller, assignors to Apple Electric Co. Details of plunger-operated, snap switch.

1,158,967. Means for Detecting the Presence at a Distance of Icebergs, Steamships and Other Cold or Hot Objects. L. Bellingham, Turnbridge Wells, England. Comprises thermopile sensitive to infra-red wave lengths.

1,158,971 and 1,158,972. Electric Furnace. P. A. Boeck, assignor to Norton Co., Worcester, Mass. First patent: open-end receptacle has resistor in grooves in sides and bottom. Second patent: furnace chamber of refractory material has heat-distributing and equalizing envelop comprising previously molten alumina inclosing resistor and preventing overheating thereof.

1,158,988. Electrical Musical Instrument. J. C. Deagan, Chicago, Ill. Bells have electromagnetically operated hammers selectively controlled with provision for vibratory or single-stroke operation, as desired.

1,158,991. Spring Motor. A. F. Dixon and B. F. Merritt, assignor to Western Electric Co. Has electromagnet arranged to wind the spring.

1,158,997. Arc-Lamp Electrode. C. Field, Third, assignor to National Carbon Co., Cleveland, O. Carbon with double fluorides of potassium and zirconium.

1,159,021. Storage Battery. H. S. Hawkins, A. M. Green and I. W. Gibbins, Alturas, Cal. Unit having alternate disks of lead oxide and porous material clamped on a rod.

1,159,035. Storage-Battery Grid. W. S. Hutchinson, Montreal, Que., Canada. Columnar grid unit of conducting material carrying active material has peripheral covering of insulation held in position by transverse bars of insulation.

1,159,040. Electrical Distribution. N. Joleen, Chicago, Ill. Maximum-demand meter system.

1,159,046. Dynamo Suspension on Car Trucks. P. Kennedy, assignor to Consolidated Railway Electric Light & Equipment Co., New York, N. Y. Structural details.

1,159,047. Electric Lamp. H. Kimura, Gunn, Wyo. Pair of lamps mounted on handle are adjustable with relation thereto and each other.

1,159,061. Self-Starter for Internal-Combustion Engines. A. H. Midgley and C. A. Vandervell, Action Vale, England. Special structure comprising motor-driven friction wheel engaging periphery of flywheel.

1,159,074. Safety Device for Elevators. O. I. Nigh, Washington, D. C. Car-operating controller on one side, and cutout switch, which must be held to close operating circuit, on other side of door so that operator must obstruct doorway to operate car.

1,159,082. Electric Control for Delivery of Power. C. R. Pratt, assignor to Universal Speed Control Co., New York, N. Y. Differential gearing controlled by pilot motors.

1,159,093. Rheostat. T. Rhodus, Chicago, Ill. Helical resistance having its axis bent into a ring, has an interior rotatable contact arm successively engaging its convolutions.

1,159,111. Incandescent Lamp. F. Skaupy, assignor to General Electric Co., Schenectady, N. Y. Bulb contains halogen compound of thallium for lessening light obscuration by deposit of tungsten on bulb.

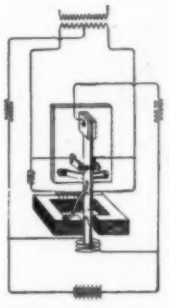
1,159,121. Dynamo-Electric Machine. C. W. Starker, assignor to Westinghouse Electric & Mfg. Co. Relates to structure and mounting of end members of stator.

1,159,124. Drop Light. J. I. Steen, Bakersfield, Cal. Special structure for ceiling attachment comprising spring take-up drum for cord and laterally extending telescopic arm having cord pulley at its end for adjusting lamp laterally.

1,159,126. Plate and Film Numbering Machine. J. R. Stephenson, Pullman, Wash. Details of mechanism employing electric light for printing the numbers.

1,159,128. Electric Security Device. C. Stille, Friedenau, near Berlin, Germany. Relay circuit is closed by particular conjoint operation of step-by-step mechanism and time switch.

1,159,154. Apparatus for the Electrolytic Manufacture of Alloys of Light Metals with Heavier Metals and the Continuous Treatment of Such Alloys for Obtaining Final Products. E. A. Ashcroft, London, England. Arrangement of electrolytic cells for the purpose indicated.



No. 1,159,189.—Vibrating Rectifier.

1,159,157. Electric Fly-Trap. W. A. Bass, Rio Vista, Tex. Bait-holding platform is surrounded by two coils of wire of different potential spaced apart.

1,159,174. Governing Mechanism for Mixed-Pressure Turbines. J. G. Callan, assignor to General Electric Co. Working range of governor for valves of turbogenerator set is controlled jointly by the high-pressure valve mechanism and falling off of generator load.

1,159,179. Flashlight Apparatus. J. L. Courson, assignor of one-half to T. D. Evans, Barberton, O. Igniting circuit of charge is closed by operation of camera-shutter-operating mechanism and new charge is electromagnetically brought into position when mechanism is released.

1,159,188. Intercommunicating Telephone System. G. Deakin, assignor to McMeen & Miller, Chicago, Ill. Pair of talking wires have a guard wire associated with them through which busy test and ringing circuits are alternately made.

1,159,189. Vibrating Rectifier. J. T. Dempster, assignor to General Electric Co. Electromagnetic vibrator operated by alternating current delivers the alternations as unidirectional impulses. (See cut.)

1,159,205. Protective Device. C. F. Frank, assignor to General Electric Co. Lightning-arrester horn gap has ground connection through mass of carborundum granules of critical breakdown voltage.

1,159,207. Attachment-Plug Receptacle. G. A. Gauthier, assignor to Arrow Electric Co., Hartford, Conn. Has rotary shutter with apertures normally out of register with receiving terminals but which may be moved into registry to admit plug contacts.

1,159,209. Method of and Apparatus for Producing Electrical Impulses or Oscillations. R. H. Goddard, Worcester, Mass. Ga. Circuit is connected to heated Wehnelt cathode in rarefied atmosphere and resulting beam of electrons is deflected alternately on number of anodes connected with the circuit, the currents inducing oscillations in another circuit.

1,159,224. Dynamo-Electric Machine. T. Hoock, assignor to Westinghouse Electric & Mfg. Co. Arrangement of air chambers and fan for ventilation.

1,159,226. Transformer. S. E. Johannesen, assignor to General Electric Co. Primary and secondary coils arranged one within the other have interposed magnetic shunt of iron ribbon wound transversely to leakage flux and having one end connected to core.

1,159,228. Electrical Winding. E. Keidel and F. Sieber, assignors to General Electric Co. Arrangement of windings on three-legged, three-phase transformer.

1,159,274. Vehicle Lamp. A. M. Roland, San Francisco, Cal. Arrangement of reflectors and lenses.

1,159,278. Artificial Electric Minnow. A. Sampey, Springfield, Mo. Head and tail portions joined by rigid strips separating transparent strips through which light shines from interior lamp bulb.

1,159,294. Electric Safety Device. T. J. Tobin, assignor to Bryant Electric Co., Bridgeport, Conn. Fuse receptacle and plug proportioned according to rating to prevent attachment of fuse of improper capacity.

1,159,296. Printing-Camera. J. Trimbach, Rye, N. Y. Unitary portable structure has electric light carried on collapsible support which is extended in printing.

1,159,306. Illuminating Apparatus. F. H. Weston, assignor to General Electric Co. Lamp receptacle adapted to be attached to line wires has provision for detachably securing a shade thereto.

1,159,307. Electrical-Discharge Device. W. C. White, assignor to General Electric Co. Device for detecting high-frequency oscillations.

1,159,312. Electric Automobile-Signal. F. A. Wright, Scranton, Pa., assignor of one-half to W. J. Brong. Illuminated direction-indicator has pointer electromagnetically controlled.

1,159,315. Induction System of Train Control. G. P. Finnigan, Wilton-on-James, Va. Signal and speed control controlled by flux change in magnetic circuit on car, on passing magnetic mass in track.

1,159,335. Seal for Vacuum Apparatus. F. G. Keyes, assignor to A. A. Noyes, Boston, Mass. In vapor electric apparatus barrier of yielding material is interposed between the fluid and a seal comprising a metal tube sealed in the vitreous envelope, to prevent injury of the metal tube.

Patents Expired.

The following United States electrical patents expired on November 8, 1915:

613,663. Connector. F. E. Case, Schenectady, N. Y.

613,669. Brush-Holder. A. E. Doman, Elbridge, N. Y.

613,688. Electric Switch. F. A. L. Roche, New York, N. Y.

613,705. Electric Timing Race Apparatus. J. I. McDonald, St. Joseph, Mo.

613,708. Electric Railway. J. F. McLaughlin, Philadelphia, Pa.

613,735. Electric-Circuit Controller. N. Tesla, New York, N. Y.

613,744. Mechanism for Holding Trolleys to Their Wires. W. R. Weaver, Covington, Ky.

613,778. Indicator Signal. P. Rabbidge, Syndey, N. S. W., Australia.

613,794. Electric Railway. W. M. Brown, Johnstown, Pa.

613,809. Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles. N. Tesla, New York, N. Y.

613,853. Electric Regulator. W. H. Chapman, Portland, Me.

613,864. Phosphorescent Electric Lighting. D. M. Moore, Newark, N. J.

613,869. Controlling Device for Electric Motors. F. J. Russell, New York, N. Y.

613,875. Marine Governor. J. T. Austin, Detroit, Mich.

613,880 to 613,882. Generating and Distributing Electric Energy. C. M. Green, Cleveland, O.

613,894. Dynamo and Electric Motor for Driving Vehicles. J. V. Sherrin, Ramsgate, England.

613,899. Instrument for Measuring Electric Currents. E. C. Eldredge, Springfield, Mass.

613,918. Electric Lighting System for Vehicles. R. N. Chamberlain and A. S. Hubbard, Belleville, N. J.

613,955. Flashlight Apparatus. S. D. Alter and L. T. Young, Philadelphia, Pa.

614,012. Primary Battery. C. Koenig, Berlin, Germany.

614,025. Brush-Holder for Dynamo-Electric Machines. G. L. Pratt, Atlanta,